DRAGON USER

International edition

The independent Dragon magazine

60p US$2.60 January 1984

Hints to give your programs the edge

A computer test for your TV

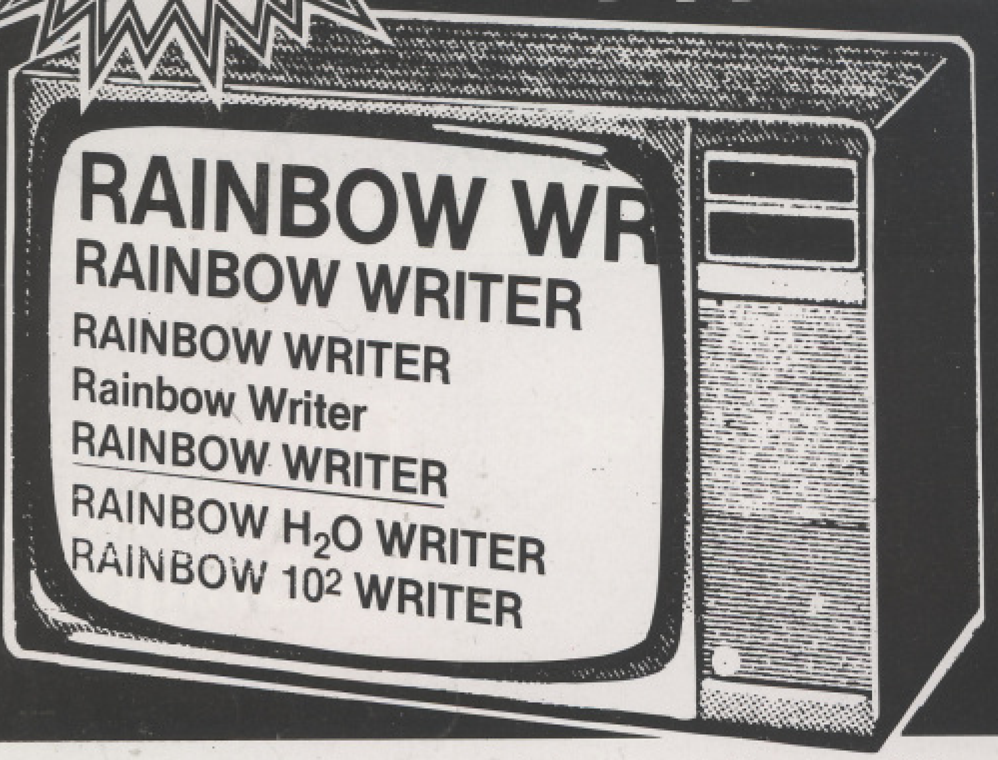
The lowdown on upgrades for Dragon

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How to submit articles

The quality of the material we can publish in *Dragon User* each month will, to a very great extend, depend on the quality of the discoveries that you can make with your Dragon. The Dragon 32 computer was launched on to the market with a powerful version of Basic, but with very poor documentation.

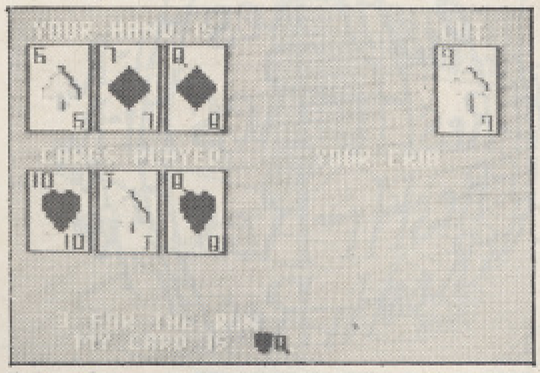
Every one of us who uses a Dragon will be able to discover new tricks and quirks almost every day. To help other Dragon users keep up with the speed of the development each of us must assume that we made the discovery first — that means writing it down and passing it on to others.

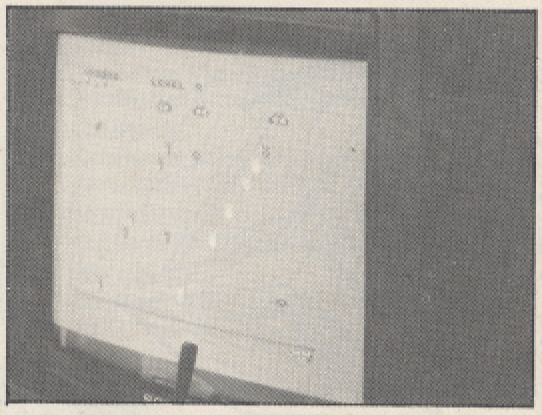
Articles which are submitted to *Dragon User* for publication should not be more than 3000 words long. All submissions should be typed. Please leave wide margins and a double space between each line. Programs should, whenever possible, be computer printed on plain white paper and be accompanied by a tape of the program.

We cannot guarantee to return every submitted article or program, so please keep a copy. If you want to have your program returned you must include a stamped, addressed envelope.

Contents

SUNSHINE





Editorial

THE SAGA of the official Dragon 32 upgrades is continuing, with Dragon Data being dogged by statements it has made in the past.

Predictions on the cost and timing of the upgrade varied considerably during the course of last year. First, an expansion box giving 64K of RAM was proposed for the middle of May. Then the add-on was expected to cost about £30. By June this had become a board-swap at a cost of £75. A month later plans had changed to a CPU swap scheduled for September at an expected cost of about £100. This swap was to give Dragon 32 users 64K of RAM, two ROMs and an RS232 interface. At the time Tony Clarke, Dragon Data's former managing director, explained that software compatibility was behind the second thoughts — the proposed CPU swap would enable Dragon 32 software to run on the Dragon 64.

However, come autumn, with Brian Moore newly installed as managing director, and the plans had become less specific. Now it seems possible that the company is having further second thoughts — preferring to exchange Dragon 32s for 64s rather than upgrade them. The logistics of a part-exchange would certainly be simpler than swapping CPUs which would originally have involved service agents. Less certain is the reaction of Dragon users to the cost of such a proposal — write to tell us what you think and we'll make sure your views are known.

Part-exchange would be a new idea in this country, although Commodore used it in the US, reducing the price of its 64 to Vic20 owners returning their machines. Commodore, however, has not been so generous about software compatibility. The American company has been content to split the market for its two home computers, so that Vic20 users moving up to a CBM 64 have been left with redundant software. Commodore does not seem to have suffered too much from this unco-operative attitude and some people argue that Dragon Data should have taken a leaf from the American company's book. The suggestions, from businessmen in the micro industry rather than from micro users, is that Dragon Data's intentions may be too honourable for its own good — again, let us know what you think.

Letters

This is the chance to air your views — send your tips, compliments and complaints to Letters Page, *Dragon User*, 12-13 Little Newport Street, London WC2R 3LD.

Calling all clubs

I WOULD like to know if there are any microcomputer clubs in the North Leicestershire area for teenagers. So far I have not been able to find any after two months of searching.

J Wong,
Loughborough,
Leics.

Dragondos criticised

WE THINK we have found two bugs in the Dragon 32 disk operating system.

The first is related with the CHAIN command. This command allows the user to load and run a second program using the same data as the first program. The bug is, it sometimes pushes the program into the Dos's buffer, crashing the program. Possibly, this can be overcome by executing a FRE$ command in conjunction with the CHAIN command.

The second is a lot more serious and concerns the RUN command. The syntax for the RUN command is RUN "DRIVE : FILE NAME. BAS" for a Basic file or .BIN for a machine code program. The use of a disk system can be made easy with a disk maintenance program. The user only uses one "key" command and types the program's name; the rest is under software control. For example, INPUT F$ (FILE NAME) LOAD F$ + " .BAS "

This will LOAD the program F$. The bug is that the RUN command cannot accept a STRING VARIABLE. All other commands seem to be OK.

H Francis and D Barrell,
Cardiff.

. . . and defended

I READ the recent article by Keith and Steven Brain, comparing the Dragon Data and Premier disk systems, with interest (and, by the end of the article, some annoyance).

I've used the DD unit regularly since I bought it in mid-September and find it very useful for program development — from my standpoint several of the features the Brains' view coolly seem very useful. The automatic creation of a backup file removes the possibility of a too-frequent clot-error — creating a new file (sometimes with nothing in it!) with the same name as a wanted older version.

Equally important, it's reassuring to find the dictionary is duplicated on tracks 16 and 20. Several of the toolkit commands (especially AUTO) are also surprisingly useful, and make for a more user-friendly system (a characteristic the Brains rightly hold dear). Everyone is entitled to his own view on the value of these commands (and I'm clearly quite happy with them). However, when it comes to the question of file-structure, I find myself at variance with your reviewers over matters of fact.

On the Brains' own definitions, the two principal file-types are "random-access", in which "each record can be read from or written to independently" and "serial files" in which "to recover a particular item you must start from the beginning and work your way through all the items in sequence until you find what you are looking for", and in which "adding data to, or deleting data from the middle necessitates rewriting the whole file". They claim that the "file-handling capabilities of Dragondos are relatively simple, and effectively restricted to the serial type" and that the example given in the Dragondos manual entitled "simulated random-access" "really describes a rather inefficient serial file with lots of blank spaces in it".

This would, indeed, be an important criticism, if true. Since reading these comments, I've spent some time playing around with these "simulated" random-access routines and looking at the results on disk using SREAD (a function the Brains pass quickly over).

It appears that the technique in the manual does indeed replace new data in a record in the bytes vacated by the old record, without rewriting the whole file (there are no "holes", except those that pad out the fixed-length record) and that it accesses all records on an equal and rapid basis (the complex structure of the Dragondos dictionary would be a waste of time if it were otherwise!). However, that this is a random-access, rather than a serial technique doesn't really require deep study — it's evident just on using it a few times.

B Hall,
Bristol.

A pause alternative

IT IS often necessary to pause a program by either using the FOR-LOOP method such as:

FOR I = 1 TO 500:NEXT I

or

TIMER = 0:IF timer = 5000 THEN . . .

But these methods can be both time and memory consuming. A much better method, especially if you only want a relatively short delay in the program is to use the Dragon's Play command by typing PLAY"P1", which gives a delay of about 2⅓ seconds or PLAY"P5" for a shorter pause.

K F Kam,
Manchester.

Harder Pontoon

WE HAVE enjoyed playing with the Pontoon game submitted by I Saunders (Open File, September 1983) but thought that readers might be interested in this slightly more realistic (and harder!) version.

The following features have been added: an ace now counts as 1 or 11 (most of the calculation for this was in the original); the computer is allowed to twist an extra card, and decides whether to do so a bit at random; a five-card trick is rewarded with a tune.

On the technical side, the POKEs have been removed since they are not necessary in this type of game; you can speed things up by shortening the wait loops if you wish. Defined functions have been used to calculate the card values and check for aces.

The changes to the original version are as follows:

```
65 DEF FNA(Q) = INT((Q –
   1)/13)
67 DEF FNB(Q) = FNA(Q) =
   (Q – 1)/13
160 FOR X = 1 TO 3:GOSUB
    1000:C(X) = Z: NEXT X
300 IF R£ = "N" THEN 380
    ELSE IF R£ = "E" THEN
    END
330 REM Check for Aces
350 IF PT > 21 AND FNB(P(X))
    THEN PT = PT – 10: P(X)
    = 0
365 IF PT > 21 THEN CLS
    4:PRINT @ 230,"SORRY!
    YOU'VE BUST!";:CH = CH
    +1:SOUND 50,5:GOTO
    460
392 IF CT < 16 + RND(3)
    THEN L = 22:C =
    C(3):GOSUB550:CT = CT
    + T
395 FOR X = 1 TO 3:IF CT > 21
    AND FNB(C(X)) THEN CT
    = CT – 10:C(X) = 0
397 NEXT X
407 IF CT > 21 THEN CLS
    4:PRINT @ 230,"OOPS!
    I'VE BUST!";SOUND
    150,5:GOTO450
```

Lines 410, 420, 430, 440 can all be simplified in a similar way.

```
425 IF K = 6 THEN CLS
    5:PRINT @ 66,"FIVE
    CARD TRICK!";:FOR A = 1
    TO 5:PLAY
    "T5004FCFC":NEXT
    A:GOTO 450
460 SCREEN 0,1:FOR A = 1 TO
    1000:NEXT A:GOSUB 5010
500 FOR A = 1 TO 1000:NEXT
    A:GOTO 90
```

Del 510-540 since we are likely to want many more games.

```
570 RETURN
4010 S = FNA(C) + 1
4040 IF N > 10 AND N < 14
     THEN T = 10 ELSE T = N
5035 SCREEN 0,1
```

We find that it is much harder to beat the computer at this game, and spend many tries to get the elusive five-carder!

P and S Harris,
Sunderland.

Software Top 10

1	(4)	**Frogger**	Microdeal
2	(7)	**Mined Out**	Quicksilva
3	(–)	**Cuthbert in the Jungle**	Microdeal
4	(1)	**The King**	Microdeal
5	(10)	**Ring of Darkness**	Wintersoft
6	(–)	**Champion**	Peaksoft
7	(–)	**Pettigrew's Diary**	Shards
8	(–)	**Drone Data Tank**	Cablesoft
9	(–)	**Dragonfly 2**	Hewson Consultants
10	(–)	**Empire**	Shards

Chart compiled by Boots


Games that come from...
BEYOND
CHALLENGING SOFTWARE
UP PERISCOPE
PROTECT the convoy using SONAR + Depth charges to seek out and destroy the enemy below!
Try and pick off your Enemy from below the waves!
Kriegspiel
...How much longer can we hold this town...?
Here comes the first flakes of snow and out of it – their Tanks!
KRIEGSPIEL: A thrilling game of strategy to be played against the Dragon or any other devious apponent.

Part-exchange path preferred

DRAGON DATA has decided to part-exchange 32s for 64s rather than upgrade them.

The rumoured cost of the exchange to a 32 user is £140, saving £85 off the cost of a Dragon 64 — possibly less than can be raised by selling your 32 second-hand.

This price, and the policy itself, mark a change from the company's original intentions.

Earlier in 1983 Dragon Data was proposing to offer an upgrade service, at a price which eventually rose to about £100.

Some users are likely to object both to this change of policy and to the cost involved.

Adopting part-exchange not only breaks with Dragon Data's previous statements but also with tradition.

Only Commodore has pursued such a policy, and that only in the US where it dropped the price of its CBM 64 to Vic20 owners returning their machines.

Full details of the part-exchange are contained in the December issue of Dragon Data's newsletter *Stop Press*.

New home for Ninja Warrior

A ROW over UK distribution of cassettes from American software house Programmers' Guild has been settled.

The cassettes, among the best-sellers in the US and including such titles as Ninja Warrior and Pacdroids, are now being distributed by Program Factory, 39 Railway Road, Darwen, Lancashire.

Program Factory is also handling previously unfilled orders sent to Programmers' Guild UK — and will be handling any new US titles which cross the Atlantic.

Monster challenge

A PRIZE of £10,000 could be yours if you solve five games from Twig Systems Software and then win its Countdown Quiz.

The suite of six games, developed in association with disc jockey Dave Lee Travis, are designed to test your intelligence, powers of reason and keyboard dexterity.

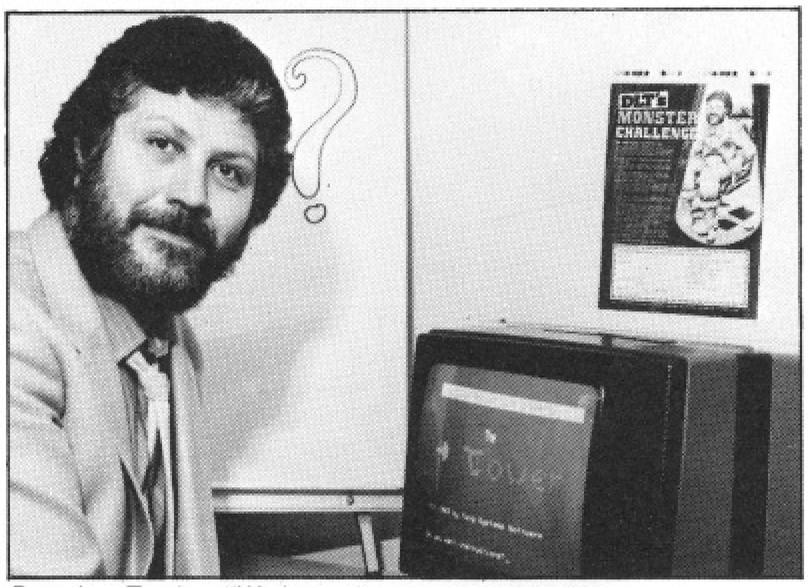
Dave promises: "These games will have people beating their heads on the floor with frustration."

But if you can solve the first five you may be eligible for the Countdown Quiz, whose winner will receive £10,000.

At the moment the games run on the BBC and Sinclair micros as well as the Dragon. Each costs £9.50.

Dave added: "We know the games are difficult — we just don't know how difficult. So we don't know how long it will take us to get the 10 finalists together."

Twig Systems Software can be reached at 6 High Street, Wendover, Bucks.



Dave Lee Travis – "We know the games are difficult"

Dragon Data software push

DRAGON DATA is stepping up its attack on the software market, issuing new titles for the 32, bundling games for disk users and marketing professional packages for the OS-9 operating system.

The range of new games for the 32 includes arcade titles, adventures and simulations — alone and in combinations.

For example, Lunar Rover Patrol is an arcade-type game using "superb graphics" to simulate the moon's surface, while another tape combines two games: the arcade Breakout and the adventure Middle Kingdom.

Other adventures include Viking, Monsters and Magic and a trilogy from US software house Colourquest. Simulation fans have Tee-off and Flight to look forward to.

Dragon Data has also licensed Bridge Master from Intelligent Software, the people behind the already available Chess.

Of particular interest to readers of *Dragon User* will be the arrival of Junior's Revenge, whose author was interviewed in our October issue. This is a Dragon version of the arcade classic Donkey Kong Jr, as Microdeal's The King is of Donkey Kong.

All these games will be appearing in new packaging of video cassette-size cases — as will the previously announced new releases.

Dragon Data also has plans for disk drive users. The company wants to make sure that "people who buy drives don't feel left out," explained technical software manager Duncan Smeed.

Cassette and cartridge titles are being bundled together on disk in threes, fours and fives — to give, for example, an adventure disk.

The modular operating system OS-9 will now be available in January at a price of around £40.00. The software is ready, but the manuals still have to be finished.

Duncan thinks that OS-9 is Dragon's "passport" to the small business/serious home user market — particularly in the light of the system and application software that will also be available early next year.

System software includes Pascal and Basic 09, a structured version of Basic which is itself similar to Pascal. In fact Duncan says "it's got so many extra features you can't really call it Basic any more".

A C compiler will give the system "a high degree of portability" so that "any program that runs under Unix can run under OS-9".

These languages can also be used together under OS-9, with each module being written in the source language most suited to the task.

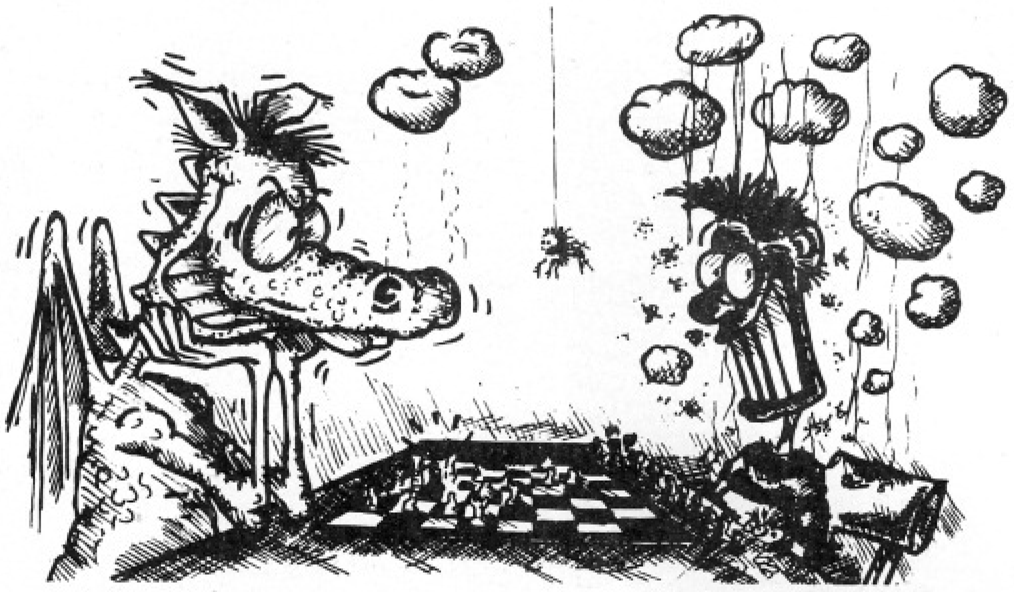
Applications software includes a word processing package called Stylograph at £80.00, Dynacalc for spreadsheet analysis, and RMS for database management, both at £60.00.

Stylograph, which benefits from the 51 by 24 line screen on OS-9, also offers a spell checker and mail/merge facility.

Duncan stressed that this "inexpensive" pricing is no reflection on the packages' quality. "These are very, very professional products which we can offer at these prices only because of our high volume purchasing and licensing agreements," he explained.

DRAGON CHESS

OASIS SOFTWARE



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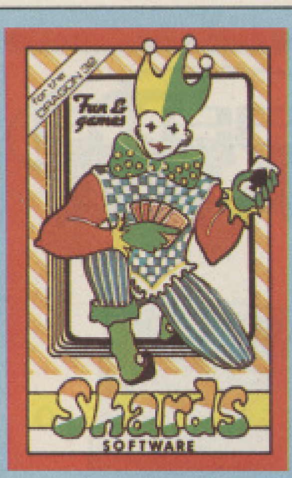
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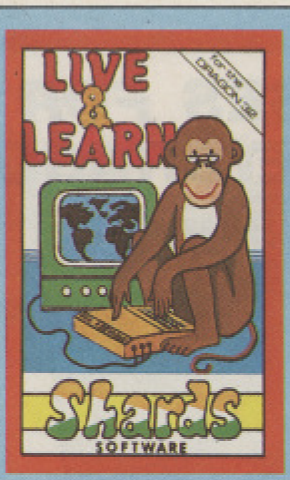
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for family entertainment

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for the arcade fan

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SHARDS

SOFTWARE

FOR THE DRAGON 32

THE FAMILY FAVOURITES



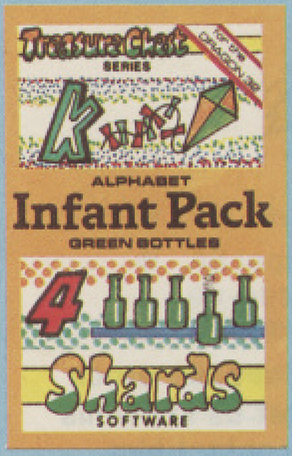
for the jigsaw fanatic

Jigsaw puzzles were never like this! Three games of skill, judgement and speed. With a range of skills to suit all ages. **£6.95**



for fun learning

Recommended education for 6 to 12-year-olds. Designed and used in schools. Menu-driven, including Space Hangman, Counting, Word Mixer, Code Breaker and Calculator. **★ £6.95**



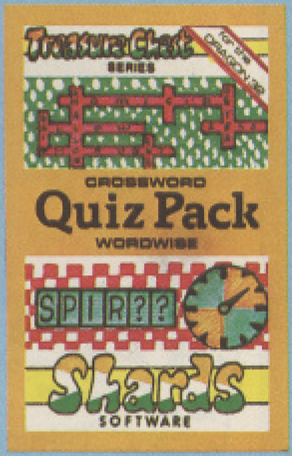
for the toddler

Pre-school education, learn the alphabet (upper and lower case), and simple counting. All in 100 per cent hi-res graphics with musical score. **★ £3.95**



for the school kid

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Flex in state of flux

ONE DOOR to the Flex high level operating system has closed as another two open.

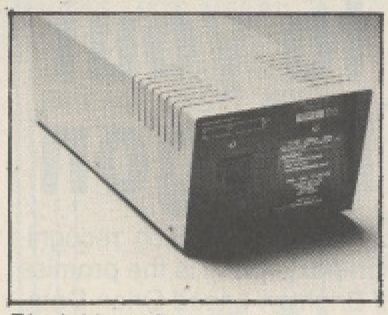
Microcare has decided not to offer the system, but the 68 Micro Group and Premier Microsystems, the first people to put out disk drives for the Dragon, are going ahead with their respective plans.

Dragon Data itself intends to offer OS-9, which provides multi-tasking but as it is a younger system has less applications software available.

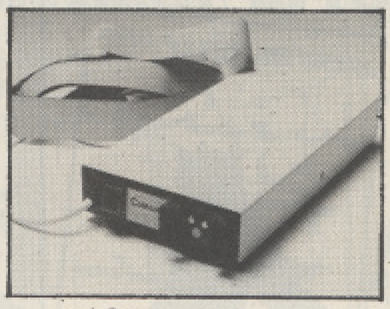
The 68 Micro Group, whose aim is to bring together all users of the 68 family of microprocessors, has developed a Flex card which includes two serial interfaces and 8K of RAM.

Jim Anderson, the group's chairman, pointed out that the extra RAM memory means that 32 as well as 64 users should be able to use the card, which will also operate as a stand-alone controller.

Marketing details have not been finalised yet but he expects the card to be available early next year, costing less than £200.



Rival drives: Dragon Data's . . .



. . . and Cumana's/Premier's

Premier too has committed itself to making Flex available — but has not decided the final details yet.

Premier's Mick Bedford commented: "As users we have always believed that Flex is better than OS-9." Aside from the wider range of software, he is also impressed by the PL-9 language which he regards as easy to use but capable of advanced applications.

Mick also thinks it will be "good to have a choice of high level operating systems on the market".

Microcare's Eric Brooks thinks otherwise. He has decided that Flex is "no longer the viable proposition it was" and "reluctantly" will not be going ahead "because of market developments".

Premier, which developed the Delta operating system used in the Cumana drives, has two other projects up its sleeve which will be of interest to disk users.

First in line is an EPROM enabling the Dragon disk operating system to operate as a Delta system. This will cost £60, including the much-praised Delta manual.

Next up, in January, will be a utility extending compatibility in the other direction — it will enable the Delta system to read Dragon disks.

Pricing has not been decided yet but Mick promises that this "won't be a very high cost item".

Scottish pseudo sprites arrive

PSEUDO-SPRITES are promised by new Scottish software house Screenplay.

The firm's first package for the Dragon, The Animator, can be used in any of the micro's five high-resolution modes.

It consists of two integrated programs — a character generator and an animation routine developing pseudo-sprites.

Characters are defined using the first program, whose facilities include the ability to rotate characters round all three axes. Then they are saved and loaded into the second program for machine code animation.

Once written the animation sequences can be incorporated in games and other more complicated sequences.

The Animator costs £9.95 and Screenplay can be contacted at 134 St Vincent St, Glasgow.

Talking to your Dragon

LOW COST speech recognition next spring is the promise of Brighton-based Orion Data.

Called Micro Command, Orion's speech module translates commands spoken via a microphone into signals which your Dragon will understand.

The module, with microphone attached, slots into the Dragon's edge connector socket.

A Teach program loaded from cassette allows you to train the Dragon to recognise up to 15 words you speak into the microphone. A Listen program then checks that the words are being recognised correctly.

An instruction leaflet explains how to incorporate the spoken commands into your own programs or use them to replace keyboard or joystick control in other games.

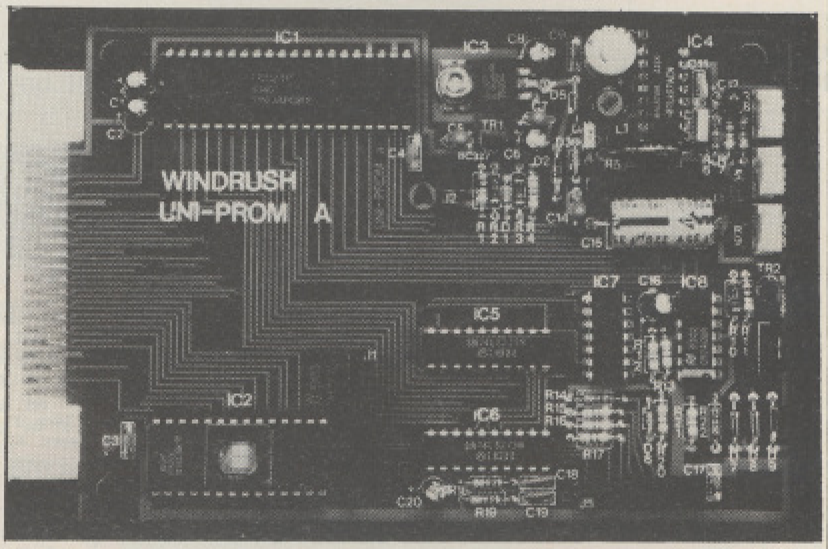
The cassette also contains Sheeptalk, a game which already uses speech commands.

Micro Command already runs on the Spectrum at £49.95 and Orion expects to have a Dragon version available at the same price next spring.

Included in the price are the speech recognition module, microphone, cassette and instruction leaflet.

Orion Data's address is 3 Cavendish St, Brighton, Sussex.

Windrush bring in Bug-Zapper



Inside Windrush Micro Systems' Bug-Zapper EPROM programmer

THE latest programming tool from Windrush Micro Systems is Bug-Zapper, an EPROM programmer which takes its place alongside the Mace assembler and D-Bug disassembler.

Bug-Zapper plugs straight into the Dragon's cartridge port and needs no extra power supplies or batteries. It is a development of Windrush's professional EPROM programmer which is already in use on OS-9 and Flex, the two main operating systems for 6809-based micros.

The cartridge includes an 8K ROM with all the software necessary to operate the programmer. The choices on the menus provide a range of facilities.

For example, you can FILL the programmer buffer with specified hex characters, MOVE data within the buffer, EXAMINE/CHANGE the contents, and then DUMP them to the screen or printer.

Bug-Zapper costs £79.95 complete with documentation. For an extra £10 you can buy the EPROM programmer and Mace on the same cartridge.

Mace is Windrush's editor/assembler/monitor which sells at £29.95. It also comes in a combined cartridge with D-Bug for an extra £20.

D-Bug, a tracer/monitor/disassembler package, costs the same as Mace on its own. Owners of either cartridge are being offered a £15 trade-in allowance.

BEHIND THE SCENES AT PEAKSOFT



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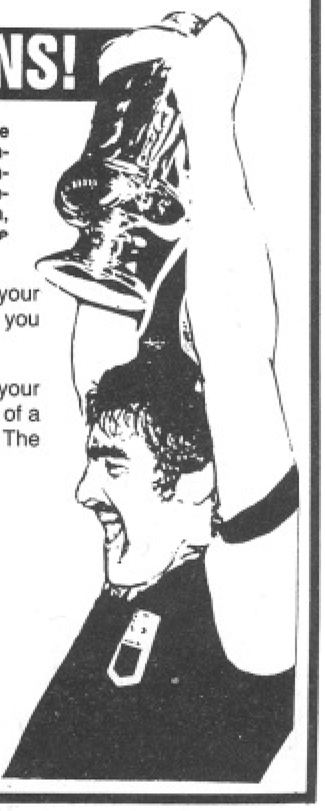
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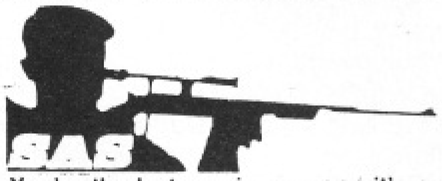
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Desert Island Dragon delights

***John Scriven** picks his favourites from the past year's offering of software – revisiting arcade halls, crib tables, strange lands and programmers' benches*

AT THIS TIME of the year, there may well be more family disputes than usual over TV use. With parents and kids all at home at the same time, even the family with two sets could find problems in sharing these out fairly. The delights of James Bond, Top of the Pops and The Incredible World of Disney have to be carefully weighed against alien destruction, maze exploration and the latest database program. If someone is also hiring videos then you would indeed be lucky to get through unscathed.

My advice would be to buy copies of Radio and TV Times as soon as possible and draw up a timetable of TV use if you want to avoid the divorce courts in the New Year. Just think, only five years ago there were hardly any micros in the home, few videos, and only three channels to argue over; such is the price of progress . . .

For those of you with any money left (let alone sanity), after the Christmas madness, I have been casting my eyes over the year's software in an attempt to suggest best buys. In the past I used to grade programs on a 1 to 10 scale for use of graphics, speed, novelty, sound, etc, and end up with a league table of results. This came to be more and more difficult as I realised that so much depended on personal taste and I have avoided this approach recently. However, the editor came to me on his knees muttering something about "desert island cassettes" and "which ones would you like to be marooned with?" As there was a threatening look in his eye I decided to comply before I found myself shipwrecked with eight copies of Invaders and my Dragon for company.

I have tried to spread the net as wide as possible to include a variety of programs, but undoubtedly there will be some good ones that escape.

My favourite arcade games tend to be those that avoid aliens rather than pursue them, and those that show originality as well as fast action are more likely to get my vote.

On the mat

Ninja Warrior, from Programmers' Guild is an obvious choice here. Starting out as a martial arts training program, it increases in difficulty to make TV's Kung Fu look like Playschool. In this excellent game, you, and up to five other players, control a small figure dressed in a judo suit. The ground scrolls beneath his feet, and you can use the joystick to slow him down, speed him up, or make him jump in the air. The 'fire' button controls his sharp karate kick.

To gain a white belt, the landscape is littered with boulders that he can jump over, but a higher score is achieved by kicking them to dust. If he survives this without breaking his toes, the tests for higher grade belts present him with fires to jump over, pits to traverse and even arrows to catch. Eventually your warrior becomes a black belt. I find this a highly entertaining game, using a novel idea, smooth graphics and good sound. My one criticism is that the little figure looks more like Ken Livingstone than Bruce Lee.

Hit list

Dragon Data Kenfig Industrial Estate Margam Port Talbot West Glamorgan	**Berserk** £19.95
Microdeal 41 Truro Road St Austell Cornwall	**Space Shuttle** **Phantom Maze** **Cuthbert in the Jungle** All £8.00
Salamander Software 27 Ditchling Rise Brighton East Sussex	**Franklin's Tomb** £9.95
Wintersoft 30 Uplands Park Road Enfield Middx	**Ring of Darkness** £10.00
Programmers' Guild Unit 6 Scotshaw Brook Branch Road Lower Darwen Darwen Lancashire	**Ninja Warrior** £8.95
J Morrison Micros 2 Glensdale St Leeds	**Vultures** £6.95
Premier Microsystems 208 Croydon Road Anerley London	**Cribbage** £8.95
Windrush Micro Systems Worsted Laboratories North Walsham Norfolk	**Mace Editor/ Assembler/ Monitor** £29.95

Me Tarzan, you Cuthbert

Cuthbert in the Jungle is the most recent game in the Cuthbert series from Microdeal, and is by far the best in terms of graphics.

Using the joystick, you control Cuthbert, making him run to the right or left and jump. As he disappears off the screen on one side, he reappears on a fresh screen with some new hazard to confront him. These vary from logs and pits to scorpions, quicksands and alligators. Occasionally, he thinks he's Tarzan and swings from carefully placed vines. Eventually, he discovers various treasures that have to be collected and brought back before the clock runs out. In order to reach the later stages, you have to acquire different skills such as calculating when alligator jaws are likely to open, how to catch swinging vines, etc. Each time you play, you improve and get closer to the treasures. This game is well worth adding to any collection.

If you feel you really have to be unpleasant to visitors from outer space, then Vultures from J. Morrison Micros is an ideal program. In this game you are given the opportunity to pit yourself against monstrous creatures that have apparently escaped from some cosmic aviary. A group of these evil birds starts in formation at the top of the screen. They then proceed to swoop down on to you, while depositing something unpleasant on your head. If you run into one, you will explode, so the only tactic is to try and shoot them before they get you.

As you mop your brow in relief at destroying this wave, some innocent-looking eggs begin to hatch out revealing more nasties who take over from their parents. Although you can never win, the path to destruction is accompanied by ▶



GALACTICANS
The first 'arcade perfect' game for the Dragon 32 & Tandy Color 16K micro computers. This superb version of the popular arcade game is written in super-fast machine code and features super-high-resolution multi-coloured graphics. Arcade quality sound effects and colour graphics.

ULTRAPEDE
A superb version of the arcade classic. Zap the Ultrapede before he reaches you, but watch out for the Spiders and Lethal Snails! Amazing graphics, four-colour screen and superb sound. One of the best ever games for the Dragon 32 & Tandy Color 16K.

MONSTERS
Your craft lands on the surface of the mines of Zol II above a maze of ledges and stairways. Your mission–to recover power modules from the mines without being caught by a Monster-Robot or running out of oxygen. Recover one module and you are off in search of another. Each time there are more & more Monster-Robots to track you down. To get past the Monsters or avoid them you can blast holes in the ledges using your laser. Superb high-resolution graphics, ultra-smooth movement and great sound effects.

UGH!
The Ice Age has come and Ugh must collect food. But stealing Pterry the Pterrodactyl's eggs may not have been the best idea! This has to be the best graphics/animation ever on the Dragon 32....A smash hit! Dragon 32 and Tandy Color 32K. Joystick compatible.

MODE 5
Quite simply this utility radically transforms your Dragon, giving you a new 'mode' in which you can freely mix TEXT and GRAPHICS on the screen. You get true lower case characters, and you can very simply change the character set you are using! Complete with 3 character sets and 'transparent' to the user.

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brief victories and should lure anyone who's had to visit the dry-cleaners after walking through Trafalgar Square recently.

Before you will be allowed into space to tackle such beasts as Vultures, you will undoubtedly need to show some sort of competence in flying spacecraft. This is why I have selected Space Shuttle from Microdeal. Standard flight simulators for micros are quite fun, but rarely behave quite like the real thing. Although they cope well with level flight, they don't produce the awful feeling in the pit of the stomach as you side-slip or get into a spin. Space Shuttle avoids these complications by switching in the auto-pilot if you fail to operate the controls competently enough.

Starting with a weather report, the program takes you through four stages in a complete mission. As the display changes to a view of the instruments and the clouds outside, countdown begins and you rise majestically through a backdrop of stars. Your first chance to control something happens now, as you leave the launch rocket behind. You have to aim for the correct orbiting position, although there is a small amount of leeway allowed. The next part of the mission is to rendezvous with a satellite. Using a joystick and the keyboard, you have to use retro-rockets to align yourself neatly into place. Once you are close to your target, the doors have to be opened in the loading bay, and the robot arm extended to the satellite which is then packed away in the cargo hold.

As the doors close, you can fire forward thrusters to begin your descent through the atmosphere. The motors shut off and you control the final glide using only the joystick. Instruments are necessary in the initial stages, but soon the runway appears through the window, and the landing can be achieved visually.

After you land successfully — or crash — a debriefing report tells you where you went wrong during the mission. As you are a trainee pilot, the auto-pilot saves you from the worst errors, and you collect points according to how close you came to the ideal route. It would be better if you could miss out the stages that you find easy and concentrate on the more difficult parts, but it is still an enjoyable program that needs careful thought as well as agile fingers.

Graphic horrors

One of the first games I saw that showed what could be done with Dragon graphics was Phantom Slayer from Microdeal. Adapted from an American program for the Tandy Colour Computer, this involves hurrying round a hedge-lined maze while avoiding its unpleasant guardians. These are phantoms who spring out at you and are difficult to destroy even though you are armed with lasers. The best technique is to shoot, turn and run for cover behind a hedge whenever you see one. The graphics are excellent, showing not only the hedges at each location, but their changing appearance as you turn around. Instead of simply showing you 90 degree views, the scene scrolls smoothly past in a way that must make other games writers feel jealous. There is audible warning of the approach of the phantoms as well as a training program to allow you to get used to the controls. There are two types of maze available, and the result is a realistic, high-speed game.

The last action game that I have included is Berserk from Dragon Data. I was cautious about including this program as it is available on a cartridge, and I still feel that these are overpriced. Where most people might buy a good chess cartridge, or a utility package on cartridge, they would certainly be nervous at spending £20 on a game that could prove boring within a few days. Berserk happens to be my favourite from the games (the others are mainly different versions of Pacman), although I know several people who find it irritating beyond belief!

Steering a little man around a room, you have to destroy robots while avoiding electrified walls and something unpleasant called 'Evil Orville', who resembles a malignant medicine ball. As you rush for an exit, a new room scrolls across the screen, and the game increases in difficulty. Although fairly simple in concept, Berserk is fast and well-written.

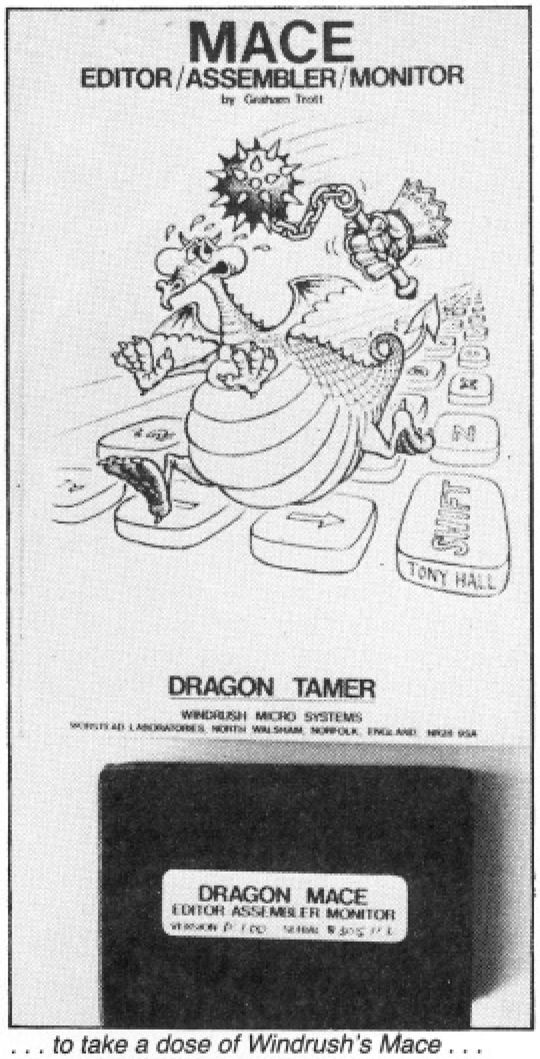
M-C delights

There comes a time when the speed and facilities offered by Dragon Basic no longer satisfy the programmer, and he or she wonders if it might not be worth the effort of learning to program in machine code, or at least to use some m/c routines in Basic programs to speed the action up. Accessing the 6809E is easy on the Dragon, but simply entering line upon line of meaningless numbers is intimidating and time-consuming, which is why I have included in this selection of software, an assembler package, Mace, from Windrush Micro Systems. This cartridge also contains an editor and a monitor and is indispensable to the m/c programmer. The documentation is 80 pages long and is fairly clear. Apart from general instructions, it gives a detailed breakdown of the 6809 instruction set, use of interrupts, and monitor and editor commands as well as examples. On plugging in, switching on, and entering EXEC 49152, you find yourself in editor mode. This gives you 20 options, including insertion and deletion of program lines, search and replace strings, load and save from tape, edit, assemble, go to system monitor or exit to Basic. There are 14 assembler directives and 14 assembly error messages, and the monitor allows breakpoints and jumps to subroutines, both vital to final de-bugging. If you end up on a desert island with this cartridge and your Dragon, remember to ask Roy Plomley for either Leventhal's or Zaks' books on 6809 programming!

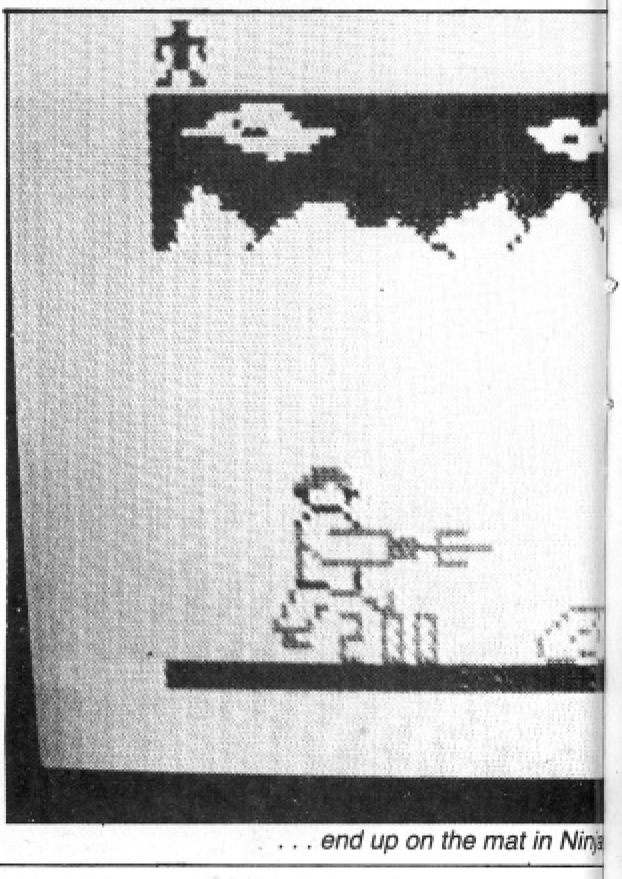
Although there are several card games available for computers, some of them seem to have little point. There is even a rather risqué version of strip poker available for the Apple. You choose which of two ladies you would like to play against, one rather incompetent and the other a world-class player. I'm not sure what you're expected to do as you gain points



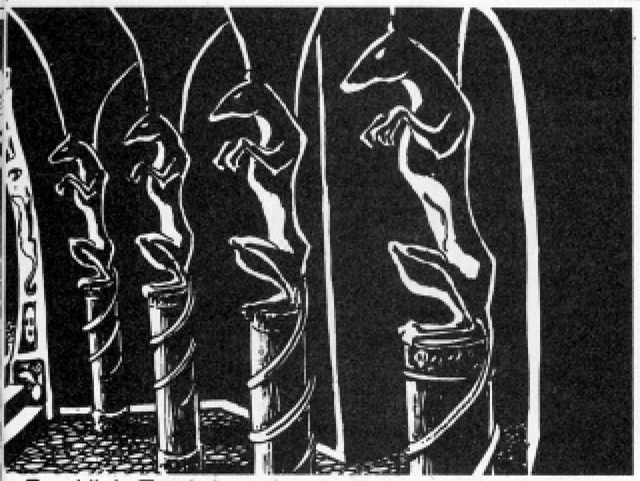
Our intrepid software reviewer survives

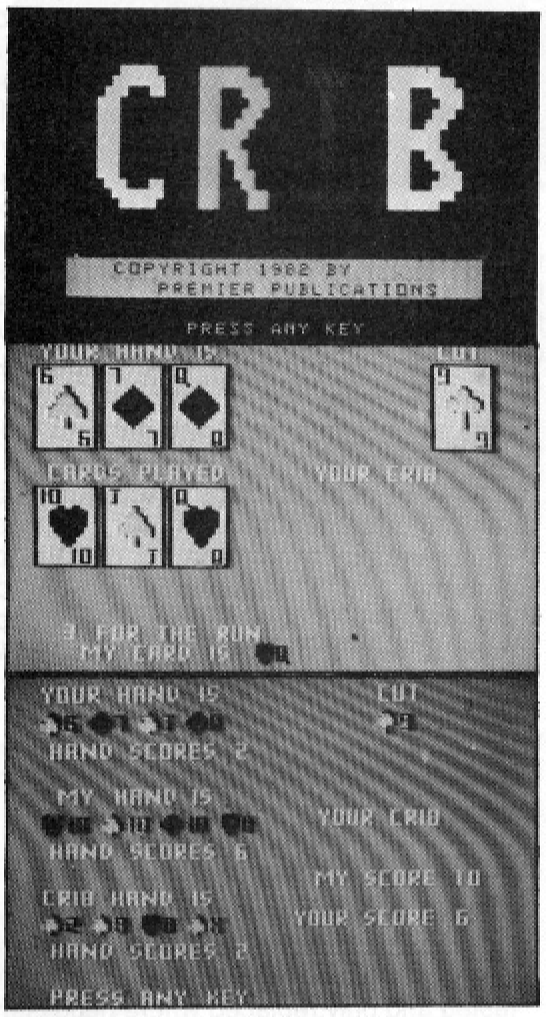


. . . to take a dose of Windrush's Mace . . .

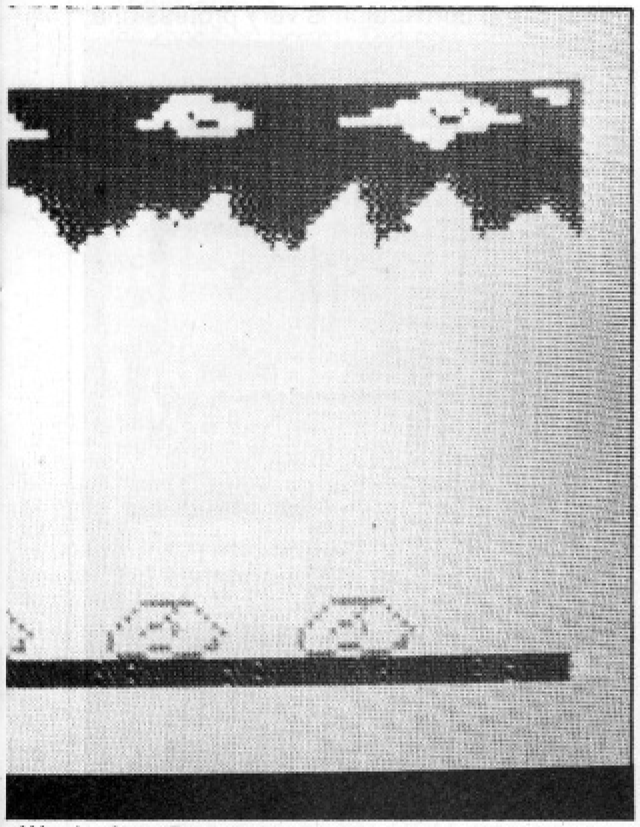


. . . end up on the mat in Ninja


Franklin's Tomb from Salamander, only . . .



. . . lose to Premier at Crib, and then . . .


Warrior from Programmers' Guild

from the feeble player, but you'd have to enjoy humiliation quite a lot to sit there in your socks as the demon player reveals five aces, but apparently this game sells quite well in the States.

If you are going to play cards, then you need to find a game that is fair for the computer to play. One such game is Cribbage from Premier Microsystems. In this, you are each dealt six cards, of which two must be placed on the discard pile. The next card is turned up to show its face. The discarded pile makes up the 'crib', which is placed to one side. Using the cards in their hands, the players take it in turns to place cards in a pile adding up the running total all the while. Runs and doubles score points, as does making 15 or 31. The total must not be higher than 31. When this point is reached, the totalling starts again. When all eight cards have been played, the players try to make 15 from their own cards (including the upturned card on the top of the pack). They take it in turns to add the crib score to their own. Scores are usually kept on a wooden board with holes in for matchsticks. The winner is the first person to move his or her matchstick around the board.

The display is very clear, with the cards shown along the top of the screen, and the reaction times are fast. Although I prefer playing this game in some tiny pub out in the country with a pint of Wadworth's 6X close at hand, this program is as good as you could get on a computer, and of course, the Dragon doesn't make you buy the next round if you lose. (Well, not yet, anyway!)

As with arcade games, choosing a favourite adventure game is very much a matter of personal choice. I enjoyed Madness and the Minotaur and the more recent selection from Dragon Data, probably because they are all clearly influenced by the Crowther original (which I still enjoy playing occasionally). The two that I have included however, are Ring of Darkness from Wintersoft, and Franklin's Tomb from Salamander.

In the dark

Ring of Darkness combines text with graphics and a Dungeons and Dragons type character choice at the start. After choosing whether you wish to be human, elf or dwarf as well as wizard, thief or warrior, you set out across a map of the terrain. Clearly shown are all the popular tourist places, such as lakes and towns. As you make your way using the cursor control keys, you soon discover that fellow travellers are anything but friendly. In fact the sooner you start thumping them, the sooner you begin to collect weapons, gold and experience, without which there is little point in proceeding further. Clearly, this game is not for the faint-hearted.

As you collect various possessions your food supply starts to run out. When you reach a town, you are shown a high-resolution plan where you can purchase food, drink, weapons, spells and even advice. At this particular stage in the Middle Ages, someone had even invented an early hovercraft, and if you have enough money, you can add this to your set of belongings. Should you not be able to avoid the hidden archers (I never could stand Walter Gabriel), then you will die and be promptly resurrected. This will cost you some possessions, but not experience points, which are increased handsomely after this harrowing event.

When you are well-equipped, you can enter one of the underground mazes to continue your quest for wealth and fame. This necessitates loading in another program that displays the maze in hi-res 3D, even allowing you to see the repulsive creatures that jump on you. Should you wish to climb the ladder to the surface once more, you simply reload the original program, and your position and present state are merged into the new program. Since I first played this game, I have become more convinced that the extra features make it worth the rather high price of £10.

In the crypt

Franklin's Tomb is also rather more expensive than the average Dragon game, but it does come in smart packaging that protects the software and doesn't simply make it look more impressive, and it does contain a booklet. Most of the locations that are visited are drawn clearly in it, and there is an introduction that sounds like Clive James reading from Raymond Chandler.

The game is set in the crypt of a graveyard, and takes you through many weird locations, several of which are neatly booby-trapped. The locations are connected logically, which means that map-making is not too much of a problem. Hidden in various places are objects and clues that are essential on the other side of the maze of tunnels. The screen is split up into three sections: location description, personal inventory of things you've picked up, and a list of available exits (start worrying when this goes blank!) There is a save file facility to save your present position on cassette, which is useful just before you launch yourself into the unknown. As this contains merely your present position and inventory, it only takes 20 seconds or so to load or save.

As you explore further through the tunnels, you begin to see the point of the game, and the location that you should be aiming for. When you reach there, you need to deposit certain peculiar objects that you have collected enroute. If you succeed in this, you are free to . . . go out and buy the sequel, Lost in Space. In spite of this rather sneaky trick, the game is fun to play, and although rather easy for experienced adventurers, most pople should get a lot of enjoyment from it.

In the next few weeks, I hope to find what Dan Diamond (the hero of Franklin's Tomb) gets up to in space. I did hope that he would reveal the phone number of his sister, Ann, but I fear this is not to be. I am looking forward to seeing what the next batch has in store for me too, when the mince pies have all gone, and I'm sure that I'll find programs that I'll wish I'd included in this selection.■

Added RAM power

Keith and Steven Brain *investigate the various upgrades offered for your 32.*

ALTHOUGH THE DRAGON 64 has now arrived on the scene there is still no firm word from Dragon Data on 'official' upgrades for your faithful 32. In the meantime independent sources are already offering ways of upgrading the 32 towards the specification of the 64.

The most immediately obvious way to add more memory to your Dragon is to fill the cartridge port area with RAM and this approach has been taken by Moray Microsystems which manufactures a cartridge that can contain up to 14K of battery-backed non-volatile CMOS memory.

The module has full buffering on the data, address and control lines together with the necessary decoding circuitry and RAM. The version shown in Figure 1 has sockets for 6 x 2K chips but only two of these are filled in this 4K example.

Either normal low-power or ultra low-power CMOS static RAM chips may be fitted, the only differences between these being the price and the power consumption. A Nicad battery is fitted which is trickle charged when the module is plugged into the Dragon and a memory protect switch is provided to prevent accidental read/write operations and also allow removal of the cartridge.

Advantage

One advantage of this system is that data in the cartridge will be retained as long as the battery power holds up. This retention time varies according to the amount of RAM fitted and the type selected but varies from 83 days for the 4K version with ultra low-power CMOS to 4.7 days for 14K with normal low-power CMOS. The cartridge area is not available directly to Basic and therefore a small machine code routine must be used to transfer data to and from the module although access times are very fast (about 50mS/K).

The module thus provides a virtually instantaneous method of storage and retrieval of data for the non-disk user who might find it particularly useful for temporary storage of programs under development. Another obvious use is holding utility programs and in addition the module could be used to simply provide extra memory for data or to transfer data/programs between Dargon computers.

Prices range from £40 for 4K to £52 for 14K of normal CMOS with prices for ultra lower-power RAM being about 15 per cent higher. The main advantages of this method of adding memory are that data and programs can be easily stored for extended periods, and of course, as the case of the Dragon does not have to be opened, your original Dragon Data warranty is not affected. On the other hand, as CMOS RAM is still expensive it is inevitable that this upgrade is not cheap. In addition adding memory externally in this way does not allow the versatility of memory handling available through internal modifications.

Microcare of Rode Heath, Stoke-on-Trent (no connection with Microcare of Thane Villas, London) will carry out internal modifications to your Dragon to expand the memory of your 32 to 64K for £60 (with a free copy of a FORTH implementation thrown in).

Microcare began life last year when partners Eric Brooks and Peter Beeston noticed a shortage of joysticks for the then new Dragon 32, and set about trying to fill it with their own product. With suitable circumspection they projected a modest rate of growth in the market but were actually amazed to find that they had to continually double and redouble their production rate to keep pace with demand until they have currently become one of the major suppliers to the trade in this area.

They then examined more esoteric hardware projects for the Dragon and came up with a 64K upgrade for the machine, which has now been available for some months. Although this conversion has not been generally advertised, Microcare has now modified over a hundred machines for enthusiasts who have mainly heard of their transplants on the grapevine.

The basic architecture of the Dragon hardware is very similar to that of the Tandy Colour Computer and a vast reservoir of technical information on this was already available in the numerous CoCo magazines from the USA. The principles of what must be done were therefore relatively easy to define.

As well as actually physically replacing the RAM chips it is necessary to reassign the pin pads, rearrange the read/write lines to access the extra memory, and make a small number of physical links on the board. One of the first problems that they found when they came to upgrade Dragon 32s, was that there are at least seven significantly-different versions of main board, all of which need to be treated differently!

Although all versions contain 32K of user RAM this value is achieved in a number of different ways. Most Dragon 32s contain 16 x 16K RAM chips. Early versions have half of these on the main CPU board itself, with the second eight on a 'piggy-back' board mounted above these (Figure 2a). Later versions have all sixteen chips mounted on the main board itself. Smaller numbers of boards contain either 8 x 32K RAM chips or even 8 x 64K RAM chips. (Although in fact the 64K chips fitted in these cases are supplied to Dragon Data as only 'half-good' and only one side was actually connected to give 32K).

As none of these chips is socketed, it is difficult to remove them without specialist equipment, or a combination of a lot of patience and a reasonable amount of experience of desoldering. The Editor (who is very sensitive to telephone calls from irate parents!) insisted that we emphasise at this point that this is NOT a job to be done by a novice on the kitchen table whilst everyone else is busy watching Dallas.

Replacement

In each case Microcare replaces the existing RAM with 8 x 64K chips. Where 64K chips were originally fitted these are tested and only replaced where necessary (you might even get a rebate). The standard of the conversion is very professional

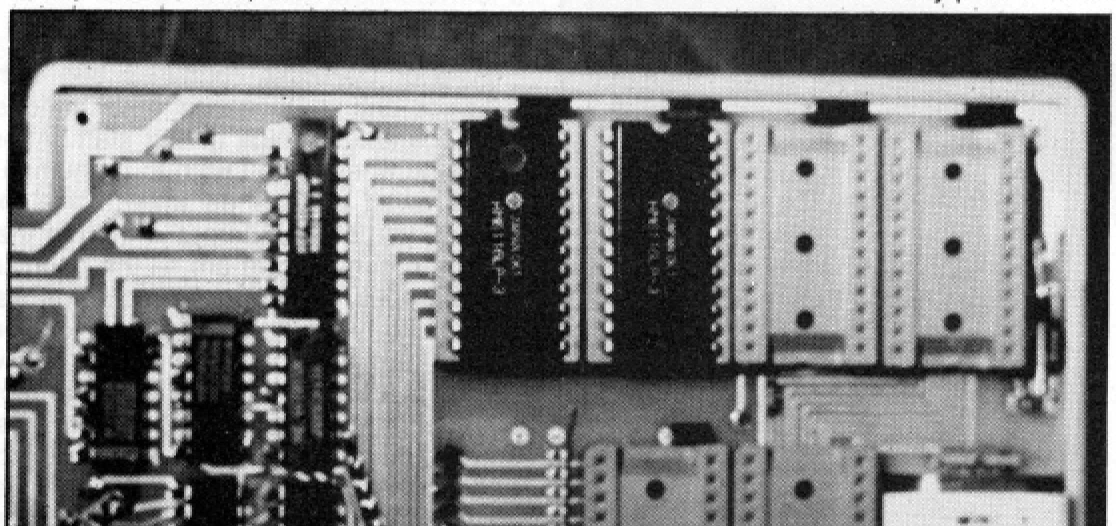


Figure 1: Moray Microsystems' cartridge – up to 14K

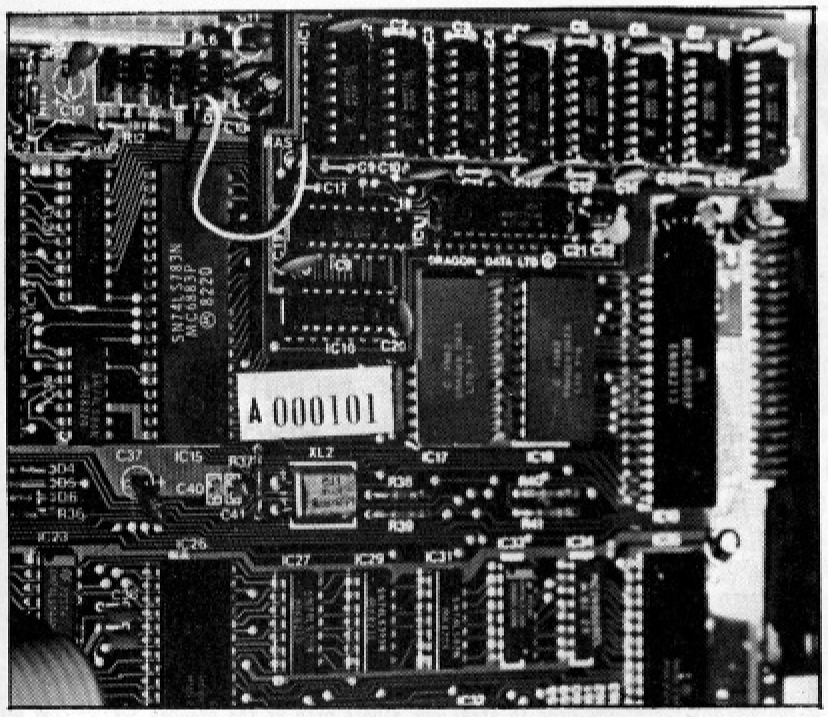


Figure 2a: before the Microcare operation and . . .

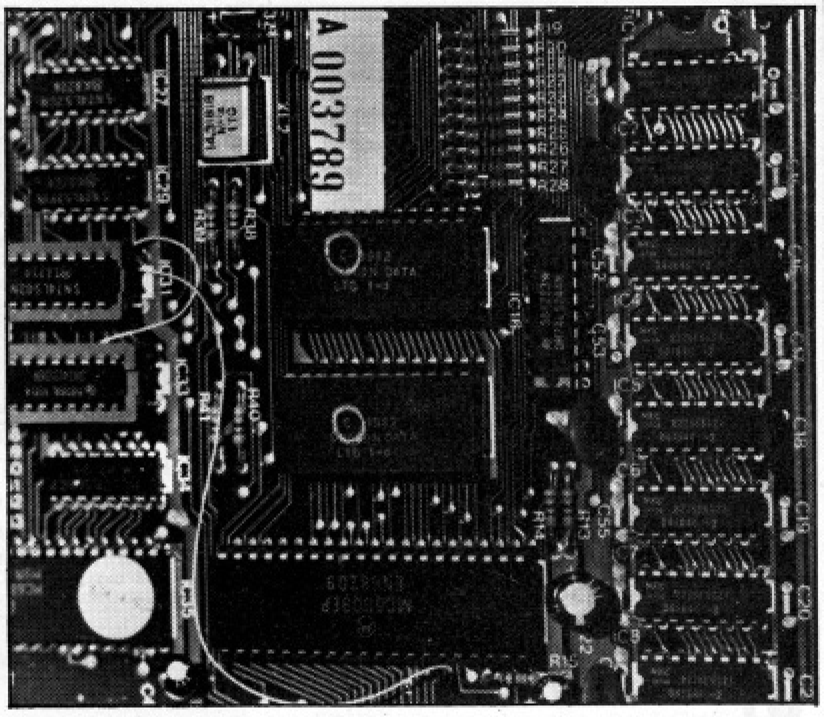


Figure 2b: afterwards – fewer chips after the modification

and if you take a quick glance at the 'before' (Figure 2a) and 'after' (Figure 2b) photographs you are very likely to get them the wrong way round, as in this case there are actually fewer chips after modification.

The conversion has been designed so that 'permanent' physical modification of the board is minimised, although with some versions some track-cutting on the main board is unavoidable. Where particular pins need to be disconnected this is arranged by fitting wire-wrap sockets to the original board locations and then clipping relevant pins on these, rather than maltreating the ICs themselves. Each machine is thoroughly tested by Microcare both before and after modification.

Unauthorised

Of course, this unauthorised work will void your Dragon Data warranty but, if you own one of the many Dragons which are now more than 12 months old, this should not worry you too much as Peter Beeston claims that no reputable Dragon Service Agent should have difficulty dealing with the modified board. The conversion is only available direct from Microcare, which has so far been operating a virtual return of post service.

The manual provided with the upgrade was originally designed for the enthusiast who already had a reasonable amount of technical knowledge but it is currently being revised as the potential readership has widened. After conversion, the modified Dragon 32 contains 64K of RAM accessible to the user in a similar way to that in the Dragon 64. On power-up the machine appears, and behaves, in exactly the same way as a standard 32.

In this mode the area from &H8000 to &HFEFF is allocated to the Basic ROM and cartridge port as usual (map type 0). Now that you have the upgrade you can switch to map 1 by simply altering the appropriate register in the SAM (Synchronous Address Multiplexer) chip by POKEing any number into location &HFFDF. This gives you almost 64K of available RAM but absolutely no control over this area as the ROM memory area has been switched out so nothing is giving instruction to the CPU.

Clearly this is of no value whatsoever unless you take steps to regain control. To be able to run Basic in 64K mode you must copy the contents of the ROM into RAM. Microcare provides a machine code ROMSHIFT program in the basic price which carries out this task for you automatically when you CLOADM it as usual in 32K mode and then EXECute. This gives you a copy of Basic in RAM in exactly the same position as it normally occupies in ROM. This will run all existing Dragon 32 software as usual. However, in addition, the old cartridge port area now contains almost 16K of RAM which can be accessed by the user.

The only drawback is that as this area is above Basic it is not recognised by the system and can only be reached by machine code routines, or PEEKing and POKEing from Basic. As the Basic is running in RAM it can be modified (customised) by the user but on the other hand the speed-doubling POKE &HFFD7,0 will not now work as this does not operate on RAM memory. Of course you can use the copy of Basic in RAM to LOAD another language (such as FORTH) and then call up the new language which can even use the Basic RAM area as workspace as this is no longer required.

Address	MAP TYPE 0	MAP TYPE 1
&HFFFF – &HFEFF	I/O only	I/O only
&HFEFF – &HC000	Cartridge Port	User RAM
&HC000 – &H8000	Basic ROM	
&H8000 – &H600	User RAM	
&H600 – &H400	Video Display	
&H400 – &H000	System use	

Problem tackled

As we described in last month's issue of *Dragon User,* Dragon Data has fitted two copies of the Basic ROM to their new 64, the second being a reassembly of the source code at higher locations to get around the problem of the code being position-dependent. Microcare has solved this problem in a slightly different way by also having available a ROMMOVE program for an extra £8-10 which first relocates the Basic ROM contents to the top of memory and then rewrites all the absolute addresses in this area to the correct values now required, to give you a full 46.5K of memory directly available to Basic (as on the real 64). It is not clear at this point how compatible this version is with the second ROM on the Dragon 64 but, for example, it will not contain the new key autorepeat routine implemented on the 64.

The manual points out that it may be possible to copy ROM cartridges into RAM but takes pains to point out the legal implications of such action. It certainly seems morally justifiable to us for a user to take such action with his own cartridges, so that he can take full advantage of his machine, and in any case the 'hot-shot' cartridge manufacturers often include 'anti-pirate' routines in their ROMs which write garbage all over the code if it is transferred to RAM to prevent just such copying! Where a utility ROM cartridge is integrated with the Basic it is usually necessary to use a modified version of he ROMSHIFT program to move the routine to RAM.

Microcare has been running the 64K upgrade in conjunction with the Premier/Cumana Delta disk drive system for some time but compatibility of the official Dragondos has not yet been thoroughly tested. As long as Delta is operated from the ROM in the cartridge it functions ▶

◀ okay but if the Disc Operating System is copied into RAM and operated from there it will only run in single density as the double-density mode uses the high-speed of the CPU which is not available in RAM.

Paging 96K

Another important point explained in the manual is that by using a simple machine code paging routine it is possible to access a total of not just 64K but 96K of memory on the Dragon (64K of RAM, 16K of Basic ROM, and 16K of cartridge port). Using this technique it is possible to 'hide' up to 32K of machine code routines in the top half of the RAM and thus, for example, run the Premier Microsystems Delta Disk Operating System, Encoder 09 Editor/Assembler, and Toolkit at the same time as the Scribe hi-res text display routine and yet still have plenty of room for your programs.

For example, you could have the DOS and Encoder 09 in ROM in the cartridge area and Toolkit and Scribe in the same locations in RAM, as long as you have a machine code switching routine which jumps back and forth between map type 0 and map type 1 at appropriate points. Of course the area in ROM and the cartridge port cannot have direct access to the RAM area above &H8000 and vice versa.

If you are really determined to get the most out of your Dragon then this upgrade will unleash considerable power at a reasonable price. The FORTH package thrown in is not exactly the last word on the subject, and you will certainly need to buy a good book on FORTH if you are a new user, but it does give you the opportunity to try out the language, and anyway what can you expect for a freebie?

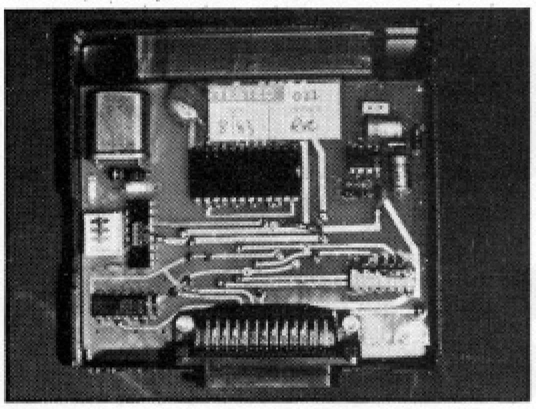


Figure 3: RS 232C interface in cartridge form

COMPANIES OFFERING the upgrade services reviewed in this article are:

Moray Microsystems
17 Kirkton Place
Elgin
Moray
IV30 3JR

Microcare
1 Oakwood Road
Rode Heath
Stoke-on-Trent
ST7 3TG

Cotswold Computers
Park Hill
Hook Norton
Banbury
Oxon

The other major addition in the specification of the Dragon 64 is an RS 232C interface allowing serial communication with printers, other computers, modems etc. Cotswold Computers/CP Engineering Services are already offering an RS 232C interface in cartridge form (Figure 3) for the 32 at £50 which includes a 24 page manual giving clear explanations of both the RS 232C standard and communication procedures together with some examples. The module uses a memory mapped 6850 ACIA, decoded from FF40 to FF5F, rather than the 6551 ACIA, decoded from FF04 to FF07, used in the Dragon 64, so it appears that software for the 64 will not be directly compatible, although of course the serial communication standard itself is the same.

Compatibility

The baud rate is controlled by an external DIP switch rather than by POKEing the ACIA registers. As this is a cartridge, it cannot be used at the same time as a disk system or other cartridge (without an expansion motherboard) but it will not affect your warranty and modems are available from the same source from £40. Microcare has produced a few 'one-off' internal RS 232C ports for individual customers and is currently planning to offer a standard modification, which will be linked to the main bus by ribbon cable so that the case does not need modification to contain the socket. This will be designed to be totally compatible with the Dragon 64 system, and the target price is £50. ■

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A breakdown of machine code

***Bruce Devlin** gives some hints on writing your own machine code programs*

MOST PEOPLE are against learning machine code because they think of it as being too advanced and too difficult for them. What they don't realise is that machine code is only as difficult as you want to make it. The only dodgy thing about machine code is that the machine is running free and very fast with no safe BREAK key to help you out when things go wrong (as they inevitably do). The correct approach to writing a program will not eliminate all the hazards but it will make it a lot easier and quicker to write.

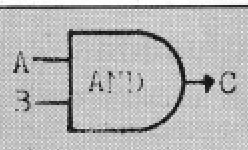
The first step is to sit down with a pencil and paper and decide on what the program will do. Once you have thought through just about all the possible errors somebody using your program could make, the next thing to decide on is what modules you are going to have. A module is a subroutine (or set of subroutines) which performs a certain task. For example in a typical arcade game modules and sections would be:

1. Move the ship ½ character cell to the left or right.
2. Move the bullet ½ square up the screen.
3. Move the bug in a random direction, change its colour and check to see if it has been hit by the bullet.
4. Clears the screen in black.
5. Prints the message text.
6. Generates a random number.
7. Resets the game ready for another go.

Individual modules

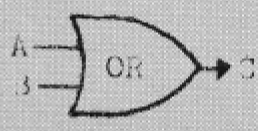
The individual modules should now be planned. Do not write any code at this stage. Merely write down what actions cause which things to happen and what errors you must check for. Once the modules have been planned the next thing to do is plan the section which knits the modules together. (If your choice of structure for your modules was good then this will be very simple). Finally write the program down on paper and then enter it into the computer. This way you will eliminate most errors before they even reach the keyboard, let alone crash the machine and lose all your hard work.

The benefits of modular programming for machine code cannot be too highly stressed. Each module should be debugged individually before being run with the rest of the program. Although it may not seem like it, this is probably the quickest way of getting an idea out of your head and on to a micro.



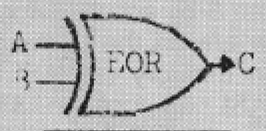
AND		
A	B	C
Ø	Ø	Ø
Ø	1	Ø
1	Ø	Ø
1	1	1

FIG.1



OR		
A	B	C
Ø	Ø	Ø
Ø	1	1
1	Ø	1
1	1	1

FIG.2



EOR		
A	B	C
Ø	Ø	Ø
Ø	1	1
1	Ø	1
1	1	Ø

FIG.3

Decisions while running

Now that you have an idea of how to write the program you will see that decisions have to be made during the running of it. These decisions can be made with the use of the CMP (CoMPare) function, but many tasks require the use of the logic group of functions.

Logic deals with true/false values which can be represented as On/Off (5V/0V) electrically and as 1/0 in binary. As there are only two states to be represented, the most compact way of storing binary values is as one bit. This means that eight logic values can be stored in one byte. The question you should now be asking is: how do you do things with one bit? In reality this isn't possible, the electronics always handle eight bits at a time, but with simple tricks with numbers and the knowledge of a few logic instructions, you can handle one, two, three . . . up to eight bits at a time.

The instructions you need to know are AND/OR/EOR/BIT. Each of these functions requires two inputs, each of which is one byte. One of the inputs is either the A or B register so you must load one of these registers with a number to begin with (this number could be the result of a calculation). The second number can be addressed any way you like (ie memory, indexed, a number etc). The 6809 then takes each byte and lines up the corresponding bits in each so that bit number 0 of each byte is AND/OR/EORed together and stored in bit 0 of the accumulator, bit number 1 of each byte is AND/OR/EORed together and stored in bit 1 of the accumulator and so on. How each of these functions works is shown in the truth tables in figures one to three.

A few examples of these functions should pave the way to showing what use they can be. A random example:

LDA #95 — put 95 into A accumulator
EORA #53 — exclusive OR with the number 53

To work out the result of this calculation first convert into binary.

95 = 0101 1111
53 = 0011 0101

Exclusive ORing each bit gives binary 0100 1010 = decimal 74 (&H4A).

An example which will prove to be more useful is the following:

LDA @NUMBER — A = contents of memory location @NUMBER
ANDA #32 — A = A ANDed with 32

Let's do the sum with two possible values of (@NUMBER): 107 and 205

107 = 0110 1011
32 = 0010 0000
AND = 0010 0000

205 = 1100 1101
32 = 0010 0000
AND = 0000 0000

You can now see that the result will be 32 if bit number 5 is set and 0 if bit number 5 (counting from zero starting at the ▶

◀ right) is not set. We have just done an operation on a single bit. To test to see if a bit is set use the AND instruction and the numbers 1,2,4,8,16,32,64 and 128. The AND instruction does have its drawbacks: it changes the result of the register permanently. This is where the BIT instruction comes in. BIT will do exactly the same as the AND instruction except that the result is discarded and the flags *only* are set (remember the similarity with CMP and SUB).

For example, when testing to see if the keys "B" and "Z" are pressed on the keyboard, a mask is put into the keyboard column output, having only one of its bits as zero. The rows are then tested (any row having a zero bit has a key pressed). Assume the A accumulator contains a row of data. If bits 2 or 5 are set then "B" and "Z" respectively are being pressed.

BITA #32 — check for "Z"
BEQ @ZPRESS — jump to @ZPRESS if bit is zero
BITA #4 — check for "B"
BEQ @BPRESS — jump to @BPRESS if bit is zero

Zero result

If the first instruction was AND rather than BIT then BITA 4 would always yield a zero result because the AND instruction would have cleared all bits except possibly bit 5. Be careful of this.

Of all the uses of the OR instruction, setting bits must be one of the most common. With the AND instruction, wherever there was a zero in the data, there would be a zero in the result. With the OR instruction, wherever there is a 1 in the data there would be a 1 in the result. A good example is text mode graphics. To generate a random graphics shape from a random byte in the B accumulator we must first make sure that the top bit (bit 7) is set, otherwise we may get a text character (CHR (128) up to CHR (255) are the graphics characters).

ORB #128 or B with 128 decimal = 80 hex

Getting adventurous

We now have a random graphics shape. Let's be more adventurous and create a random coloured fixed shape. In text mode the bottom four bits control the shape and the top four bits control the colour. To add a shape to our random colour we must first blank out the shape that is already there.

ANDB #$*F0* — clear lower 4 bits

You will notice that I am now using HEX. This is because 1 hex digit represents either the top or bottom four bits. Using HEX is, therefore, much easier to visualise the bit patterns without writing them out. Now let's add a shape to our colour. The number 6 is the shape.

ORB #6 — add the shape

These three instructions are all that is needed.

Another use

Another use of this bit manipulating is to quickly read the text screen cursor position. If D contains the address of the text cursor on the screen then the lower 5 bits will give a value of 0-31 which will be to horizontal (TAB) value of its position.

LDD $88 — load temt cursor address
ANDB #31 — clear all bits of B except lower 5
B now contains the TAB position.

The EOR instruction can be used to invert bits. If a 1 is present at any bit position then the EOR instruction will invert it.

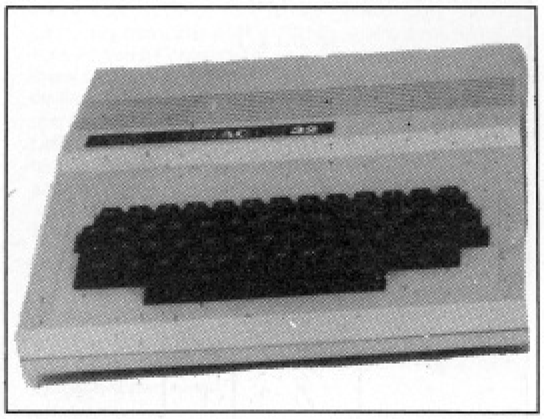
LDA #$63 — binary = 0110 0011
EORA #2 — after this A = 0110 0001
EORA #2 — 2nd time A = 0110 0011

This is because 2 in binary = 0000 0010 so bit number one was inverted every time. This is used in the Dragon to oscillate the speaker by oscillating a bit in an output port.

Shift instructions

A group of functions complementary to the logic instructions are the shift instructions. As the name implies these instructions shift a byte one bit to the left or right. The bit that drops off the end is stored in the carry flag in the Condition Code register. The instructions available are as follows:

ASLA/ASRA — arithmetic shift left/right accumulator (could be B)



LSLA/LSRA — logical shift left/right accumulator (could be B)
ROLB/RORB — rotate left/right accumulator (could be A)

By leaving off the last letter which specifies an 8-bit accumulator, it is possible to use any of the above instructions directly on memory (eg ASL $53A1 will perform ASL on location &H53A1 and store the result in location &H53A1).

To see how they work imagine that a-j are bits with values 1 or 0.

Shift left: before [abcd efgh] carry = j
after [bcde fgh?] carry = a

The "?" bit will depend on which of the shift left instructions was used:

ASL: ? = 0 } ASL and LSL are identical
LSL: ? = 0 }
ROL: ? = j

For example, let B = 116 decimal = binary 0111 0100 and the carry flag = 1
After ASLB: B = 1110 1000
LSLB: B = 0001 1000
ROLB: B = 1110 1001

Note that both ASL and LSL are equivalent to multiplying by two (B = 232).

Shift right: before [abcd efgh] carry = j
after [?abc defg] carry = h

The "?" bit will depend on which of the shift right instructions was used:

ASR: ? = a } ASR and LSR are *NOT* identical
LSR: ? = 0 }

ROR: ? = j

For example, let B contain −41 decimal = 1101 0111 (= 215 unsigned) carry = 0
AFTER ASRB: 1110 1011 carry = 1
LSRB: 0110 1011 carry = 1
RORB: 0110 1011 carry = 1

Note that ASL is equivalent to dividing a signed number by two — B now contains −20 which is INT(−41/2). LSL is equivalent to dividing an unsigned number by two — B now contains 107 which is INT(215/2).

One of the most exciting uses for these shifting instructions is for high resolution graphics games (see listing). To move a sprite (small character such as a spaceship) smoothly across the screen, a picture must be shifted between bytes. On the Dragon colour pixels are represented by two bits in a byte (4 pixels to a byte)

[a a b b c c d d]

where the bit pairs aa,bb,cc and dd are the numbers of the colour in that pixel. This means that if aa = 3 then colour 3 will appear on the screen.

If we take a 16-bit number aabb ccdd 0000 0000 and shift it to 00aa bbcc dd00 0000 it would appear that our picture had shifted one pixel to the right. A further shift would give 0000 aabb ccdd 0000.

To accomplish this the 16-bit number would be in the D accumulator. The instruction LSRA would drop the end bit into the carry flag and shift a 0 into the left hand end. RORB would then shift the carry bit into the left hand end of the B register. Repeating this would give us the required shift. This is the basis on which the program moves the 4 × 4 colour sprite left and right.

Addressing modes

There is little about the 6809 mentioned so far that is vastly different to any other processor on the market. What makes the 6809 such a powerful and flexible machine is its addressing modes. It would take a complete book to describe the operation and application of each mode so here the basic functions of each mode will be given. The names of the modes are not important but the way they work is.

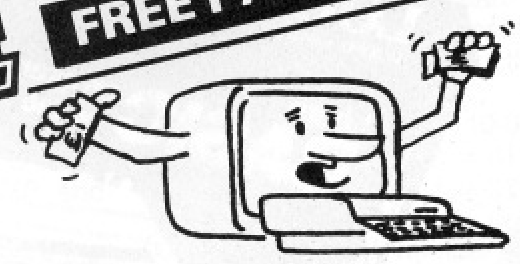
Inherent: Instructions such as CLRA, NEGB, INCB, MUL, ABX (X = X + B where B = 0 − 255). These instructions do not need any other data except for the register which is given with the instruction.

Immediate: Instructions such as ADDD #4, ORB #$F0, CMPS #$6000. Here the data is a number in hex or decimal (some assemblers allow ASCII codes to be given as data). For example ADDD 4 will add 4 to the contents of the D accumulator.

Extended: Instructions such as COM $76B1, STX 18934, JMP @START, ADDD @VALUE. Here an address is given for the instruction to use. In this case COMplement the contents of location $76B1, JuMP to the address given by the label @START, and the contents of the locations @VALUE and @VALUE + 1 to the ▶

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◀ D accumulator.

Direct: This is similar to Extended except that only the lower byte is given with the instruction. The upper byte is contained in the DP (Direct Page) register. Using this addressing mode gives faster and smaller programs. For example:
LDA #$43 — A = &H43
TFR A,DP — Load this into the DP register
LDB @LOCN — Load B with @LOCN using direct addressing.

The above example would only work if @LOCN was on page &H43 (ie the top two bytes of its address were &H43). Care must be taken that DP is correct. For Basic the DP is 0. Make sure this is so if you return to Basic.

Indexed: There are many different types of indexed addressing most of which can be indirect if desired (see below). The register R in the examples below can be X,Y,U *or* S.

,R addressing: LDA ,S is an example. Here the S register contains the address at which the byte we wish to load A with can be found.

n,R addressing: STB 8,X is an example. This is a modification of ,R addressing. Now the address is given by n+ (contents of R). In this example if X contains &H5123 the B will be stored in location &H512B. n can be any number between −32768 and +32767.

r,R addressing: INC B,X is an example. Here the number n in the last case is replaced by a register r which can be A,B or D. The contents of this register (a signed number) is added to the register R to get the final address.

,R+ ,R++ addressing (autoincrement): This is the same as ,R addressing except that after the instruction has been executed, the R register is incremented by *either* 1 *or* 2 depending on the number of plusses. CMPB ,Y+ will compare B with ,Y and then add 1 to Y. LDU ,S++ will load U from the system stack (adding 2 to the stack pointer so that it points to the next item down in the stack).

,−R ,− −R addressing (autodecrement): This is similar to autoincrement except that the register is decremented *before* the instruction is performed. STB ,−U will store the B register on the User stack and leave the stack pointer pointing to it (The stack pointer points to the location on top of the stack, ie at address ,U or ,S).

n,PCR addressing (program counter relative): This addressing mode is one that is normally only found in the instruction sets of mini and mainframe computers. To the programmer it means that you can write a program which will work wherever you put it in memory.

Indirect addressing: This is best illustrated by the following example:
LDY 2,X — load Y from the locations 2,X and 3,X
LDA ,Y — load A from the location pointed to by Y.

This can be done much more quickly and compactly by using LDA(2,X) which means load A from the address at 2,X.

Other addressing modes can be used with this indirect addressing such as INC (B,U), SUBA (@ADDR), STS (,− −U) etc. (Note that if indirect addressing is used then double increment/decrement must be used due to an address being 2 bytes long).

The instruction LEAr (r = X,Y,U or S) is available for use with all the indexed addressing modes. With this instruction, instead of calculating the address of the data and then loading/storing etc, the calculated address is loaded into the register. For example:
LEAX 4,Y — will load X with the value of Y + 4
LEAU 1,U — will load U with the value of U + 1 (ie U = U + 1)
LEAY B,Y — will load Y with the value of B + Y where B = −128 to +127

Note however that LEAS (1,U) is the same as LDS 1,U. (Can you think of other examples?)

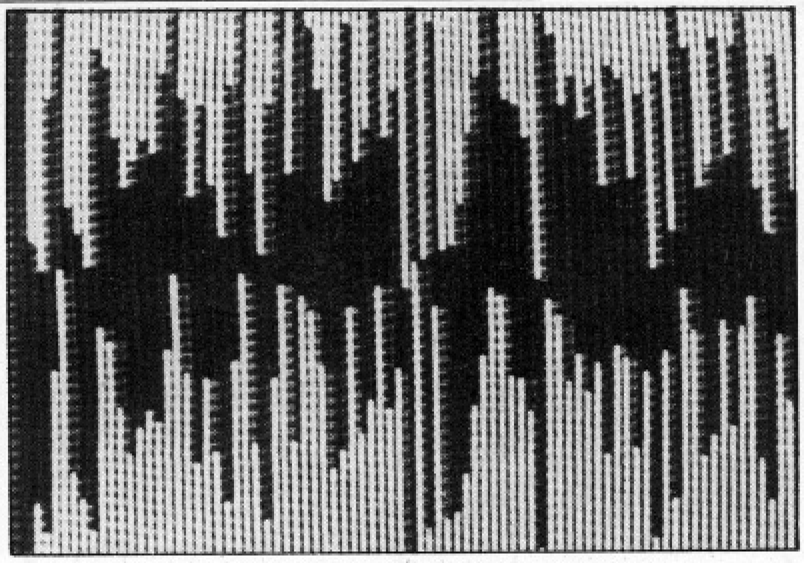
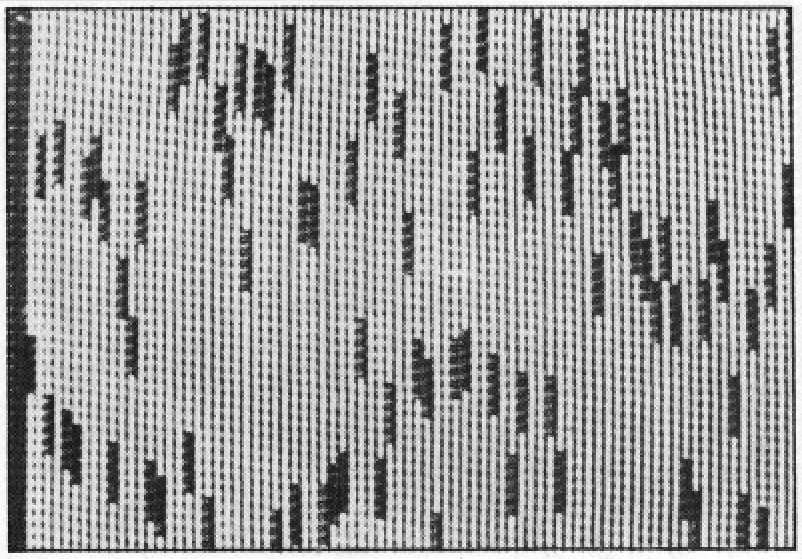
The last three instructions that are of everyday use are the subroutine instructions. These are JSR, BSR and RTS: Jump to subroutine, Branch to subroutine and Return from subroutine. JSR and BSR first put the program counter on the stack (STPC ,− −S is how the instruction would be written if existed). RTS takes this value of the program counter and goes to that address (LDPC ,S++ as before). It is therefore very important that in your subroutines, if you use the stack, you return it to the way it was when the subroutine was entered. Not doing so is one of the most common ways of crashing the machine.

You should now be at a stage to go out and buy an assembler and start playing with machine code. Once you have a bit of experience in this you will be writing programs you never thought were possible. You will be surprised at how easy it is!

(Listings courtesy of the Micro Centre in Rugby.) ■

```
(C)COPYRIGHT COMPUSENSE LTD 1983 DASM 1.6
6000                 15     ALL
6000                 20 * POSITION OF SPRITE ON SCREEN
6.00 0A00            30 @SPRPOS FDB $A00
6002                 40 * SHAPE OF SPRITE
6002 E1E1E1E1        50 @SPRITE FCB $E1,$E1,$E1,$E1
6006 FC6002          60 @PUTSPR LDD @SPRITE SHAPE OF TOP 2 SECTIONS
6009 BE6000          70     LDX @SPRPOS X=SPRITE POSITION
600C A784            80     STA ,X  FIRST LINE
600E E78820          90     STB 32,X NEXT LINE DOWN
6011 FC6004         100     LDD @SPRITE+2 NEXT 2 SHAPES
6014 A78840         110     STA 64,X THIRD LINE
6017 E78860         120     STB 96,X FINAL LINE
601A 39             130     RTS
 601B BE6000         140 @MOVSPR LDX @SPRPOS
601E A7E2           150     STA ,-S U,D,L,R INDICATOR
6020 C604           160     LDB #4  SPRITE SIZE [VERTICAL]
6022 E7E2           170     STB ,-S PUSH ON STACK
6024 8501           180     BITA #1 IS BIT NO. 0 SET
6026 2627           190     BNE @RIGHT MOVE RIGHT IF SET
6028 8502           200     BITA #2 IS BIT NO. 1 SET
602A 2746           210     BEQ @RESET MOVE VERTICALLY IF NOT SET
602C E601           220 @LEFT LDB 1,X LOAD RIGHT HALF
602E EA8821         221     ORB 33,X  ALSO LOAD NEXT HALF DOWN
6031 EA8841          11     ORB 65,X AND NEXT ONE
6034 EA8861         223     ORB 97,X AND LAST ONE
6037 2605           230     BNE @GOLEFT IF NOT BLANK GOLEFT
6039                231 *
6039                232 * SPRITE HAS BEEN SHIFTED
6039                233 * COMPLETELY INTO PREVIOUS
6039                234 * GRAPHICS CELL.
6039 301F           240     LEAX -1,X RIGHT HALF NOW CONTAINS SPRITE
603B BF6000         250     STX @SPRPOS STORE NEW POSITION
603E EC84           260 @GOLEFT LDD ,X GET SPRITE FROM SCREEN
6040 58             270     ASLB )
6041 49             280     ROLA ) SHIFT 1/2 PIXEL LEFT
6042 58             290     ASLB ]
6043 49             300     ROLA ] SHIFT 1/2 PIXEL LEFT
6044                310 *     (1 PIXEL TOTAL)
6044 ED84           320     STD ,X STORE ON SCREEN
6046 308820         330     LEAX 32,X NEXT LINE DOWN
6049 6AE4           340     DEC ,S ARE 4 LINES DONE
604B 26F1           350     BNE @GOLEFT IF NOT THE GOLEFT
604D 2023           360     BRA @RESET
604F EC84           370 @RIGHT LDD ,X GET SPRITE FROM SCREEN
6051 44             380     LSRA )
6052 56             390     RORB ) SHIFT RIGHT 1/2 PIXEL
6053 44             400     LSRA ]
6054 56             410     RORB ] SHIFT RIGHT 1/2 PIXEL
6055 ED84           420     STD ,X STORE ON SCREEN
6057 308820         430     LEAX 32,X NEXT LINE DOWN
605A 6AE4           440     DEC ,S ARE 4 LINES DONE
605C 26F1           450     BNE @RIGHT IF NOT THEN LOOP
605E A68880         460     LDA -128,X LEFT HALF OF SPRITE
6061 AA88A0         470     ORA -96,X ALSO NEXT LINE DOWN
6064 AA88C0         480     ORA -64,X AND NEXT ONE
6067 AA88E0         490     ORA -32,X AND LAST ONE
```

```
606A 2606           500     BNE @RESET IF NOT ZERO THEN RESET
606C                505 *
606C                510 * SPRITE H   BEEN SHIFTED
606C                520 * COMPLETE   INTO NEXT
606C                530 * GRAPHICS CELL.
606C 308881         540     LEAX -127,X NEW VALUE OF SPRPOS
606F BF6000         550     STX @SPRPOS
6072 E6E0           560 @RESET LDB ,S+ REMOVE COUNTER
6074 BE6000         570     LDX @SPRPOS
6077 A6E0           580     LDA ,S+ LOAD U,D,L,R INDICATOR
6079 8504           590     BITA #4 IS BIT NO.2 SET
607B 2605           600     BNE @UP GO UP IF IT IS
607D 8508           610     BITA #8 IS BIT NO. 3 SET
607F 2624           620     BNE @DOWN GO DOWN IF IT IS
6081 39             630     RTS (NOT UP OR DOWN)
6082                640 *
6082                650 * MOVE UP
6082                660 *
6082 EC84           670 @UP LDD ,X TOP LINE
6084 ED88E0         680     STD -32,X  UP A LINE
6087 EC8820         690     LDD 32,X 2ND LINE ETC.
608A ED84           700     STD ,X
608C EC8840         710     LDD 64,X
608F ED8820         720     STD 32,X
6092 EC8860         730     LDD 96,X
6095 ED8840         740     STD 64,X
6098 CC0000         750     LDD #0  BLANK CELLS
609B ED8860         760     STD 96,X BLANK BOTTOM LINE
609E 3088E0         765     LEAX -32,X NEW SPRPOS
60A1 BF6000         766     STX @SPRPOS
60A4 39             770     RTS
60A5                780 *
60A5                790 * MOVE SPRITE DOWN
60A5                800 *
60A5                810 @DOWN
60A5 EC8860         820     LDD 96,X BOTTOM LINE
60A8 ED890080       830     STD 128,X DOWN A LINE
60AC EC8840         840     LDD 64,X 3RD LINE ETC.
60AF ED8860         850     STD 96,X
60B2 EC8820         860     LDD 32,X
60B5 ED8840         870     STD 64,X
60B8 EC84           880     LDD ,X
60BA ED8820         890     STD 32,X
60BD CC0000         900     LDD #0 BLANK CELLS
60C0 ED84           910     STD ,X BLANK TOP LINE
60C2 308820         920     LEAX 32,X  NEW SPRPOS
60C5 BF6000         930     STX @SPRPOS
60C8 39             940     RTS
60C9 BD6006         950 @TEST JSR @PUTSPR
60CC 860A           960 @TSTLOOP LDA ##A
60CE BD601B         960     JSR @MOVSPR
60D1 8E8000         970     LDX ##8000
60D4 301F           970 @LOOP LEAX -1,X
60D6 26FC           970     BNE @LOOP
60D8 7E60CC         970     JMP @TSTLOOP
60DB                990     END @TEST
```

Switch Back has nine skill levels, 1 being the hardest and 9 the easiest. Above left is level 8, right is level 2.

A game to keep you on the ball

Test your skill at controlling the bouncing ball in* Simon Powney's *Switch Back

TIRED OF ZAPPING aliens or gobbling up energy pills so you can outrun the monsters? Then why not have a go at Switch Back?

This game tests your skill at manoeuvring a ball through a series of stalactites and stalagmites in a cavern. You have two controls — the arrows on the left-hand side of your Dragon's keyboard reverse the vertical direction of the ball while the arrows on the right reverse the horizontal direction. For example, if the ball is going down when either the up or down key is pressed, the ball will bounce up; if it is going left when either the right or left arrow key is pressed, it will change to the right.

Switch Back is an ideal game for both beginners and "old hands". It has nine skill levels, 1 being the hardest (there's less room to manoeuvre the ball) and 9 the easiest.

To add a little competitive atmosphere to the game the computer times how long it takes each player to get through the cavern.

Full instructions are included in the program. ■

```
0 ''''''''''''''''''''''''''''''''''
20 '''''       SWITCH BACK      '''''
30 '''''    BY SIMON POWNEY     '''''
40 '''''     @ COPYRIGHT @      '''''
50 ''''''''''''''''''''''''''''''''''
60 '         TITLE SCREEN
70 POKE 65495,0
80 CLS 0
90 PRINT@0,STRING$(96,134+32);
100 PRINT@106,"switch";CHR$(128);"back";:SCREEN 0,1
110 PRINT@128,STRING$(96,134+32);:SCREEN 0,1
120 PLAY"T1;L34;GFEC;P255;G;P255;G"
130 FOR T=1 TO 500:NEXT
140 '     ASK IF INSTRUCTIONS
150 PRINT@449,"DO YOU WANT INSTRUCTIONS(Y/N)";:SCREEN 0,1
160 P=PEEK(65280)
170 IF P=255 THEN 160
180 IF P=223 THEN GOSUB630:GOTO 210
190 IF P=247 THEN 210 ELSE 160
200 '    ASK FOR SKILL LEVEL
210 CLS 0
220 PRINT@128,;
230 INPUT"SKILL LEVEL 1-9(1=HARD)";SK
240 IF SK>9 OR SK<1 THEN 210
250 SK=SK*10
260 '  SET  UP HI-RES SCREEN
270 PMODE 4,1:SCREEN 1,1:PCLS
280 LINE(0,0)-(256,192),PSET,B
290 A=190-SK
300 FOR X=10 TO 250 STEP 3
310 Y=RND(A)
320 LINE(X,0)-(X,192),PSET
330 LINE(X,Y)-(X,Y+SK),PRESET
340 NEXT
350 PSET(5,5,5)
```

Continued on page 33

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```
360 Y=5:X=5:DX=1:DY=1
370 '''''MAIN  ROUTINE''''''''
380 IF INKEY$="" THEN 380 ELSE TIMER=0
390 A$=INKEY$
400 IF A$=CHR$(94) OR A$=CHR$(10) THEN DY=-DY
410 IF A$=CHR$(8) OR A$=CHR$(9) THEN DX=-DX
420 Y=Y+DY
430 IF Y>192 OR Y<=1 THEN DY=-DY:GOTO 420
440 X=X+DX
450 IF PPOINT(X,Y)=5 THEN DX=-DX :GOTO 420
460 PSET(X,Y,5)
470 PRESET(XX,YY)
480 IF X>=250 THEN T=TIMER:PLAY"L40;BDGEBADC":GOTO 530
490 XX=X:YY=Y  '
500 GOTO 390
510 ''''''''''''''''''''''''''''''
520 '  END OF GAME DISPLAY
530 CLS 0
540 T=INT(T/22)
550 PRINT@32,"YOU TOOK ";T;" SECONDS";:SCREEN 0,1
560 PRINT@96,"DO YOU WANT TO USE THE SAME      SCREEN AGAIN (Y/N)?";:SCREEN 0.1
570 P=PEEK(65280)
580 IF P=255 THEN 570
590 IF P=247 THEN GOTO 210
600 IF P=223 THEN PMODE 4,1:SCREEN 1,1:GOTO 360
610 GOTO 570
620 GOTO 620
630 ' INSTRUCTIONS
640 CLS
650 PRINT"             SWITCH-BACK"
660 PRINT" THE OBJECT OF THE GAME IS TO   GET A BALL FROM ONE SIDE OF THE SCREEN
 TO THE OTHER.YOU HAVE    TWO CONTROLS, THE LEFT HAND     ARROWS REVERSE THE VER
TICAL      DIRECTION AND THE RIGHT HAND     ARROWS ,THE HORIZONTAL          DIRECT
ION.";
670 PRINT" BETWEEN THE ENDS ARE A LOT OF VERTICAL LINES WITH    GAPS IN THROUGH
WHICH YOU HAVE  TO DIRECT THE BALL.";
680 PRINT@448,"PRESS TO CONTINUE.";
690 FOR T=1 TO 1000:NEXT
700 IF PEEK(65280)=255 THEN 700 ELSE RETURN
```

Add some polish to your program

How do you make your program stand out from the rest? ***Margaret Norman*** *reveals the finer points of program presentation with 10-Pin Bowling.*

MOST COMPUTER GAMES are variations on a very few themes — copies of well-known arcade games, board games, card games and so on. So what can you do to make your version stand out from the crowd?

Well, the basic mechanics of the game are obviously important and if you can introduce an original twist, that's fine — but the way in which the game is presented is bound to be a major factor in sorting out the successes from the also-rans.

Let's look at some of the minor details you will need to pay special attention to — the title sequence, instructions, high-score tables and so on — and see how some of them can be applied to one game, a computer version of 10-pin bowling.

First impressions count

First impressions always count for a lot, so the program should begin with an attractive sequence. This is especially important if the initialisation of program variables takes a significant length of time; you don't want to leave the player staring at a blank screen while this is being done.

Obviously the sort of title page you can produce will depend to some extent on the amount of memory space available, but even if you are restricted to the text screen there is no need to settle for just printing the program name in the middle of it. Here is just one alternative to that:

```
10 CLS4
20 FOR I=1 TO 13
30 READ A$: A=ASC(A$)
40 FOR J=0 TO 8
50 POKE (1033+32*J+I), A:POKE
   (1033+32*J+I), 191
60 NEXT J
70 POKE (1033+32*9+I), A: NEXT I
80 DATA N,A,M,E,O,F,T,H,E,G,A,M,E
90 FOR DL=0 TO 3000: NEXT
```

There are plenty of other options, of course; you could SET each point of the screen to a random colour before printing the title in the middle, or perhaps produce a picture, using the STRING$ command, with the title printed on it.

If you can use hi-res graphics, then obviously the scope is much greater — you can DRAW your title in any size letters, upper or lower-case, in any colour, and produce an elaborate pattern or picture as well. If you want to GET pictures into arrays as part of the program initialisation, then it may be a good idea to incorporate these into your title page.

The bowling program shows one example of this — the words "10 PIN BOWLING" are DRAWn on the screen in yellow against a blue background, with the letter I in BOWLING replaced by a skittle, then the ball to be used in the game is used to knock this skittle down. (Lines 40-160.)

You will notice that the SCREEN has not been set until after the letters and skittle have been DRAWn, so the picture will appear all at once rather than bit-by-bit The colours used have been chosen so that they will show up in black and white as well as in colour, for the benefit of those people who don't have colour televisions to use with their computers — red letters against a blue background, for instance, will not show up in black and white.

The other common element of the title sequence is a signature tune. If you can think of an appropriate song to go with your program, then you can use part of that — if not, you can always make up some music for yourself (or if you're not musical, just try a few random combinations of notes and see which sounds best, as I did).

Joystick alternative

If your game uses joysticks, then see if you can add a few extra lines to enable it to be played using the keyboard instead, for those people who don't have joysticks. If you do this, then it's a good idea to ask whether joysticks or the keyboard are going to be used straight after the title sequence, before the instructions, so that you can give separate instructions for each. You can see how to do this in the bowling game, where alternative versions of the first two lines of instructions are given.

If the instructions for your game are very long and complex, or if memory space is tight, then you may prefer to provide written instructions instead of putting them all in the program, but there's a lot to be said for at least putting brief instructions in the program itself, in case the written instructions get lost.

Optional instructions

The instructions should be made optional, so people who have played the game before can skip them, and each screenful should be concluded with a request for a keypress, so people can take as long as they want to read it (see lines 210-220, 300, 340 of my program).

Try to make the instructions as clear and concise as you can, and make sure all the words are spelt correctly — it's worth spending a few minutes checking any you're not sure of in a dictionary. Test them on a friend — if they have any questions to ask you about the game after reading them, then a re-write may be called for.

The instructions sequence will often be followed by requests for input — selection of the number of players, level of difficulty etc. Whenever you ask for some input, try to make clear what form you want it in and what range of values is acceptable, and put in a check to see that the input does fall within the given range (see lines 600, 610 for an example of how to do this).

Levels of difficulty

The bowling program has only one level of difficulty, but with most games it is possible to cater for a number of different skill levels. However, there is little point in having dozens of levels of difficulty if the differences between them are only very slight; for most games, ten levels should be plenty. Generally, level 1 should be the easiest — if you have written your game so that, say, level 10 is the easiest and level 1 the hardest, then reverse the order with "INPUT L: L=10-L".

There are lots of different ways of varying the difficulty of a game, though obviously only one or two of these will be used in any particular game. If the game is fairly fast, you can introduce a variable delay loop (eg FOR DL=0 TO 10*(10-L):NEXT DL or the number of "baddies" to be caught, evaded or shot, the accuracy of shooting required to score a hit, the time limit or the time the computer can take choosing its next move can be changed. Instead of allowing the player to choose the degree of difficulty at the start of the game, you can, if you wish, increase the difficulty gradually as the game progresses.

Next, the scoring. If you are writing a computer adaptation of a well-known game then it is generally best to stick to the scoring system of the original version as far as you can. If you can choose the method of scoring for yourself, however, there are several factors to consider.

Firstly, the highest score should normally be the best — so for a game with a time limit, for instance, base the score on the time left at the end of the run rather than the time elapsed. ▶

◄ Secondly, if you want to include a high score table your score will have to be a single number, not say, a number of points scored *and* a number of penalty points incurred. You will also have to make the score depend to some extent on the level of difficulty if you want it to be a fair reflection of the player's skill.

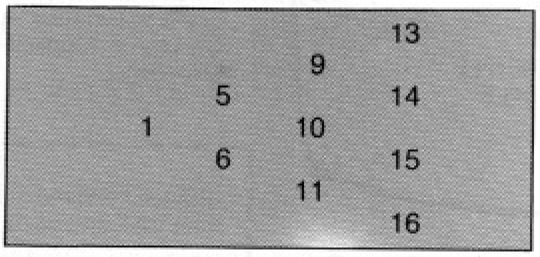
On-screen scoring is often useful; if your game uses low-res graphics then this comparatively easy to include, but if it is in hi-res then it is rather trickier. Lines 2050-2090 of the bowling program (and lines 540-580, which define the strings used in the DRAW command) show how to DRAW a three-digit number on the hi-res screen; this routine could easily be modified to deal with larger numbers. (Here the score is DRAWn on a scorecard, so the initial X and Y co-ordinates have to be calculated — for on-screen scoring, they will normally be fixed.)

Saving the high score

The high-score table routine (lines 1120-1290) uses a simple sort to place scores in their correct positions in the table. The high scores will, of course, be lost when the computer is switched off; the only way of avoiding this is to SAVE them on tape in a data file, which would involve adding two more subroutines, one to be called up at the end of the program to SAVE the data on tape and the other at the start of the program to LOAD it again. The same technique could be used to SAVE a game which is likely to last a long time. I will leave you to work out for yourself precisely how to do this.

10-Pin Bowling

This is a fairly easy game, which my children (aged seven and eight) greatly enjoy. The most important part of the program is the section (lines 1500-1750) which determines which skittles will be knocked down — producing similar results to a "real" bowling game requires some ingenuity. The process has been simplified by re-numbering the skittles:



Scoring a strike

The ball can hit a skittle in seven different places, so the function in line 1580 produces a value of H(SK) between 1 and 7. This value is then used in an ON. . .GOTO statement to determine which other skittles will fall. H(SK) has a total of 11 possible values, 0 if the skittle is left standing, 1-7 if it is hit by the ball, and 3,6,8,9 or 10 for an indirect hit. A strike can be obtained by hitting the leading skittle (No 1) slightly off-centre, and is rewarded by the screen flashing different colours and an appropriate sound.

The graphics used for the ball and skittles have been kept simple, to ensure that the game will run at a reasonable speed; much more effort has been put into DRAWing the scorecards (lines 640-740), which bear a fair resemblance to the real thing. The section of the program which DRAWs the scores on the scorecards is also fairly complex — if a strike or spare has been scored, then the score for the frame cannot be entered immediately, and A(PL,F) is set to 1 or 2 to indicate the number of balls to be played before it can be entered (lines 990-1080). ■

```
10 REM 10 PIN BOWLING       20 REM BY MARGARET NORMAN
30 REM TITLE SEQUENCE
40 PMODE3,1:PCLS3
50 DRAW"BM 5,40;C2;D20BR8U20R16D20L16":'10
60 DRAW"BM 5,110;U30R20D15L20U15BR30D30BR10U30D5F20D5U30":'PIN
70 DRAW"BM 5,130;R24F4D12G4NL24F4D12G4L24U40BR38R28D40L28U40BR38D36F4R8E4NU36F4R
8E4U36BR10D40R28BR30U40D5F30D5U40BR38L28D40R28U20L10":'BOWLNG
80 DRAW"BM161,140;G4D22F4R6E4U22H4":CIRCLE(165,134),9,2:PAINT(165,134),2,2:PAINT
(165,150),2,2
90 SCREEN1,0:PLAY"V31T10EDDEFGGFEDDDD":GOTO 390
100 BX=165:BY=12:SOUND50,1:SOUND45,1
110 FOR I=1 TO 44
120 PUT(BX-10,BY-10)-(BX+10,BY+10),B,PSET
130 PUT(BX-10,BY-10)-(BX+10,BY+10),BL,PSET
140 IF I=28 THEN SOUND255,1:SOUND253,1:SOUND254,2
150 BY=BY+4    160 NEXT I
170 FOR DL=1 TO 200:NEXT
180 CLS:PRINT:INPUT"DO YOU HAVE A JOYSTICK (Y/N)";Q$
190 IF Q$="N" THEN Z=0 ELSE Z=1
200 REM INSTRUCTIONS SEQUENCE
210 CLS:PRINT:INPUT"DO YOU WANT INSTRUCTIONS (Y/N)";Q$
220 IF Q$<>"Y" THEN 600
230 IF Z=0 THEN 360
240 CLS:PRINT"MOVE THE GREEN BALL UP AND DOWN WITH THE RIGHT JOYSTICK."
250 PRINT"PRESS THE FIRE BUTTON TO BOWL ATTHE YELLOW SKITTLES."
260 PRINT"EACH GAME CONSISTS OF 10 FRAMES.";
270 PRINT"FOR EACH FRAME, YOU HAVE TWO     BALLS WITH WHICH TO KNOCK DOWN  AS MAN
Y SKITTLES AS POSSIBLE."
280 PRINT"YOUR SCORE FOR THE FRAME WILL    NORMALLY BE THE NO. OF SKITTLES KNOCKE
D DOWN."
290 PRINT"IF YOU KNOCK DOWN ALL 10 WITH    THE FIRST BALL (A 'STRIKE') YOU WILL S
CORE 10 + YOUR SCORE FROM THE NEXT TWO BALLS."
300         INPUT"PRESS enter TO CONTINUE";Q$
310 CLS:PRINT"IF YOU KNOCK DOWN ALL TEN        SKITTLES WITH 2 BALLS (A'SPARE')YO
U WILL SCORE 10+ YOUR SCORE  FROM THE NEXT BALL."
320 PRINT"IF YOU GET A STRIKE OR A SPARE   IN THE TENTH FRAME, YOU WILL BE GIVEN
AN 11TH FRAME (AND A 12TH, IF NECESSARY)."
330 PRINT"THE MAXIMUM SCORE IS 300 (12     STRIKES)."
340 PRINT:INPUT"PRESS enter TOCONTINUE";Q$
350 GOTO 600
360 CLS:PRINT"MOVE THE GREEN BALL UP AND DOWN WITH THE ARROW KEYS."
370 PRINT"PRESS THE SPACEBAR TO BOWL AT    THE YELLOW SKITTLES."
380 GOTO 260
```

Continued on page 39

```
390 'INITIALISATION
400 CLEAR 500:PCLEAR 8
410 DIM X(16),Y(16),BL(50),B(50),N$(10),S(4,12),A(4,12),H(21),SC(10),NAME$(10)
420 DATA 165,96,190,76,190,116,215,56,215,96,215,136,240,36,240,76,240,116,240,1
56
430 'DEFINE SKITTLE POSITIONS
440 FOR R=1 TO 4
450 FOR N=1 TO R
460 SK=(R-1)*4+N
470 READ X(SK):READ Y(SK)
480 NEXT N,R
490 REM GET BALL,BLANK
500 CIRCLE(165,12),10,1:PAINT(165,12),1,1
510 GET(155,2)-(175,22),B,G
520 GET(0,0)-(20,20),BL,G
530 REM DEFINE STRINGS TO DRAW DIGITS
540 N$(0)="R4D6L4U6BR6":N$(1)="R2D6L2R3BR3BU6"
550 N$(2)="R4D3L4D3R4BR2BU6":N$(3)="R4D3NL4D3L4BE6"
560 N$(4)="D4R3NU2ND2R1BR2BU4":N$(5)="NR4D3R4D3L4BE6"
570 N$(6)="D6R4U3L4BR6BU3":N$(7)="R4D6BR2BU6"
580 N$(8)="R4D3NL4D3L4U6BR6":N$(9)="NR4D3R4D3U6BR2"
590 GOTO 100
600 CLS:PRINT:INPUT"NO. OF PLAYERS(1-4)";P
610 IF P<1 OR P>4 THEN 600
620 'DRAW SCORECARD
630 PMODE4,5:SCREEN1,1:COLOR0,5:PCLS5
640 FOR I=0 TO (P-1)
650 Y=2+50*I:DRAW"BM90,"+STR$(Y)+";R4D3L4U3D6;BE6;D6R4;BR2;U3NR4U3R4D6;BR5;U3NH3
E3;BR2;NR4D3NR4D3R4;BR2;U6R4D3L4R1F3BR4BU6"+N$(I+1)
660 LINE(2,10+50*I)-(242,20+50*I),PSET,B
670 FOR J=0 TO 23
680 LINE(2+J*10,20+I*50) -(12+J*10,30+I*50),PSET,B:NEXT J
690 FOR J=0 TO 11
700 LINE(2+J*20,30+I*50)-(22+J*20,40+I*50),PSET,B:NEXT J
710 FOR J=1 TO 9
720 X=20*J-10:Y=12+I*50:DRAW"BM"+STR$(X)+","+STR$(Y)+";XN$(J);":NEXT J
730 DRAW"BM185,"+STR$(Y)+";XN$(1);XN$(0);BR8;XN$(1);XN$(1);BR8;XN$(1);XN$(2);"
740 NEXT I
750 FOR F=1 TO 10:FOR PL=1 TO P:S(PL,F)=0:A(PL,F)=0:NEXT PL,F
760 REM START GAME
770 FOR F=1 TO 12
780 FOR PL=1 TO P
790 IF F>10 AND A(PL,10)=0 THEN 1100
800 CLS:PRINT@230,"PLAYER";PL;" FRAME";F
810 FOR DL=1 TO 1000:NEXT
820 REM DRAW SKITTLES
830 PMODE3,1:SCREEN1,0:PCLS3
840 FOR R=1 TO 4:FOR N=1 TO R
850 SK=(R-1)*4+N:CIRCLE(X(SK),Y(SK)),8,2:PAINT(X(SK),Y(SK)),2,2
860 H(SK)=0:NEXT N,R
870 GOSUB 1330
880 C(1)=S
890 IF C(1)=10 THEN GOSUB 1890:GOTO 980
900 IF F>10 AND A(PL,10)=1 THEN C(2)=10:N$(10)="BD3R4":GOTO 950
910 FOR DL=1 TO 800:NEXT
920 GOSUB 1330
930 C(2)=S-C(1)
940 IF S=10 THEN GOSUB 1970:GOTO 980
950 PMODE4,5:SCREEN1,1:COLOR0,5
960 X=4+(F-1)*20:Y=22+(PL-1)*50
970 DRAW"BM"+STR$(X)+","+STR$(Y)+";"+N$(C(1))+"BR4"+N$(C(2))
980 REM CALCULATE SCORE
990 IF F=2 THEN 1020 ELSE IF F=1 THEN 1050
1000 IF A(PL,F-2)=1 THEN S(PL,F-2)=S(PL,F-2)+C(1):K=F-2:GOSUB 2040:A(PL,F-2)=0
1010 IF A(PL,F-1)=3 THEN S(PL,F-1)=S(PL,F-2)+10:A(PL,F-1)=2
1020 IF A(PL,F-1)=1 THEN S(PL,F-1)=S(PL,F-1)+C(1):K=F-1:GOSUB 2040:A(PL,F-1)=0
1030 IF A(PL,F-1)=2 AND C(1)=10 THEN S(PL,F-1)=S(PL,F-1)+10:A(PL,F-1)=1:A(PL,F)=
3:GOTO 1090
1040 IF A(PL,F-1)=2 THEN S(PL,F-1)=S(PL,F-1)+S:K=F-1:GOSUB 2040:A(PL,F-1)=0
1050 IF F>10 THEN 1090
1060 S(PL,F)=S(PL,F-1)+S
```

Continued on page 41

```
1070 IF A(PL,F)>0 THEN 1090
1080 K=F:GOSUB 2040
1090 FOR DL=1 TO 3000:NEXT
1100 NEXT PL,F
1110 REM END OF GAME
1120 CLS:PRINT@40,"FINAL SCORES:"
1130 FOR I=1 TO P
1140 PRINT:PRINT"PLAYER";I;"    ";S(I,10)
1150 IF S(I,10)<SC(10) THEN 1240
1160 INPUT"HIGH SCORE: WHAT IS YOUR NAME ";NAME$(10)
1170 SC(10)=S(I,10)
1180 FOR J=10 TO 2 STEP -1
1190 IF SC(J)<=SC(J-1) THEN 1240
1200 T=SC(J-1):T$=NAME$(J-1)
1210 SC(J-1)=SC(J):NAME$(J-1)=NAME$(J)
1220 SC(J)=T:NAME$(J)=T$
1230 NEXT J
1240 NEXT I
1250 FOR DL=1 TO 5000:NEXT
1260 CLS:PRINT@10,"HIGH SCORES:"
1270 FOR I=1 TO 10
1280 PRINT NAME$(I);TAB(20);SC(I)
1290 NEXT I
1300 PRINT:INPUT"ANOTHER GAME (Y/N)";Q$
1310 IF Q$<>"N" THEN 600
1320 END
1330 REM MOVE BALL, WAIT FOR FIRE
1340 BX=12:BY=16:I=0
1350 SOUND 50,1:SOUND 45,1
1360 PUT(BX-10,BY-10)-(BX+10,BY+10),B,PSET
1370 IF PEEK(65280)=126 OR PEEK(65280)=254 OR PEEK(345)=223 THEN 1430
1380 PUT(BX-10,BY-10)-(BX+10,BY+10),BL,PSET
1390 IF Z=0 THEN 1410
1400 A=JOYSTK(0):BY=BY-5*(JOYSTK(1)>31 AND BY<180)+5*(JOYSTK(1)<=31 AND BY>12):G
OTO 1360
1410 IF PEEK(341)=223 THEN I = 1 ELSE IF PEEK(342)=223 THEN I = 2
1420 BY=BY-5*(I=2 AND BY<180)+5*(I=1 AND BY>12):GOTO 1360
1430 REM MOVE BALL ACROSS TO SKITTLES
1440 PUT(BX-10,BY-10)-(BX+10,BY+10),BL,PSET
1450 FOR I=1 TO 35
1460 BX=BX+4
1470 PUT(BX-10,BY-10)-(BX+10,BY+10),B,PSET
1480 PUT(BX-10,BY-10)-(BX+10,BY+10),BL,PSET
1490 NEXT I
1500 REM CHECK FOR SKITTLES HIT
1510 G=1:S=0
1520 FOR R=1 TO 4
1530 FOR N=1 TO R
1540 SK=(R-1)*4+N
1550 IF G=0 OR H(SK)>0 THEN 1600
1560 D=BY-Y(SK)
1570 IF ABS(D)>=18 THEN 1600
1580 H(SK)=INT((D+24)*3/16)
1590 K=0
1600 ON H(SK)+1 GOTO 1730,1610,1630,1640,1650,1660,1670,1680,1700,1720,1730
1610 H(SK+4)=3:IF H(SK+1)=0 THEN H(SK+1)=8
1620 GOTO 1730
1630 H(SK+4)=3:GOTO 1730
1640 H(SK+4)=3:H(SK+5)=6:GOTO 1730
1650 H(SK+4)=6:H(SK+5)=10:GOTO 1730
1660 H(SK+4)=3:H(SK+5)=6:GOTO 1730
1670 H(SK+5)=3:GOTO 1730
1680 H(SK+5)=3:IF H(SK-1)=0 THEN H(SK-1)=9
1690 GOTO 1730
1700 IF H(SK+1)=0 THEN H(SK+1)=8
1710 GOTO 1730
1720 IF H(SK-1)=0 THEN H(SK-1)=9
1730 IF H(10)=9 AND H(9)=0 THEN H(9)=9 ELSE IF H(15)=9 THEN H(14)=9
1740 IF H(14)=9 THEN H(13)=9
1750 NEXT N
1760 REM COUNT & BALNK OUT SKITTLES HIT
```

Continued on page 43

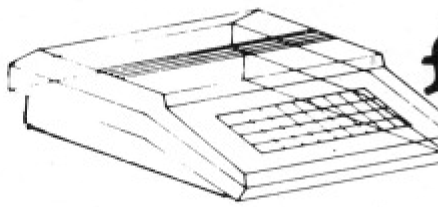
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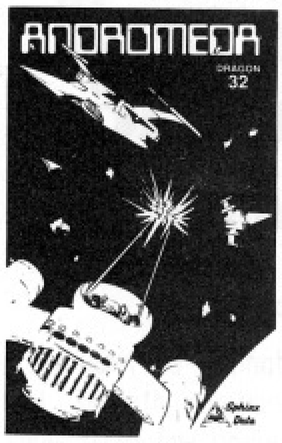
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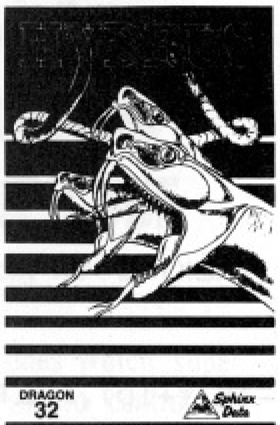
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```
1770 FOR N=1 TO R
1780 SK=(R-1)*4+N
1790 IF H(SK)>0 THEN S=S+1:IF PPOINT(X(SK),Y(SK))=2 THENCIRCLE(X(SK),Y(SK)),8,3:
PAINT(X(SK),Y(SK)),3,3:SOUND255,1:SOUND253,1
1800 NEXT N
1810 REM MOVE BALL ACROSS TO NEXT ROW OF SKITTLES
1820 FOR I=1 TO 5
1830 BX=BX+4
1840 PUT(BX-10,BY-10)-(BX+10,BY+10),B,PSET
1850 PUT(BX-10,BY-10)-(BX+10,BY+10),BL,PSET
1860 NEXT I
1870 NEXT R
1880 RETURN
1890 REM STRIKE
1900 FOR J=1 TO 4
1910 PCLS(J):SOUND200,1:SOUND190,1:SOUND180,1:NEXT J
1920 X=2+(F-1)*20:Y=20+(PL-1)*50
1930 A(PL,F)=2
1940 PMODE4,5:SCREEN1,1:COLOR0,5
1950 LINE(X,Y)-(X+20,Y+10),PSET:LINE(X+20,Y)-(X,Y+10),PSET
1960 RETURN
1970 REM SPARE
1980 FOR J=1 TO 4
1990 PCLS(J):SOUND150,3:NEXT J
2000 A(PL,F)=1:PMODE4,5:SCREEN1,1:COLOR0,5
2010 X=4+(F-1)*20:Y=22+(PL-1)*50
2020 DRAW"BM"+STR$(X)+","+STR$(Y)+";"+N$(C(1))+"BE2F10"
2030 RETURN
2040 REM WRITE SCORE
2050 D1=INT((S(PL,K)+0.01)/100)
2060 D2=INT((S(PL,K)-D1*100+0.1)/10)
2070 D3=S(PL,K)-D1*100-D2*10
2080 X=4+(K-1)*20:Y=32+(PL-1)*50
2090 DRAW"BM"+STR$(X)+","+STR$(Y)+";"+N$(D1)+N$(D2)+N$(D3)
2100 RETURN
```

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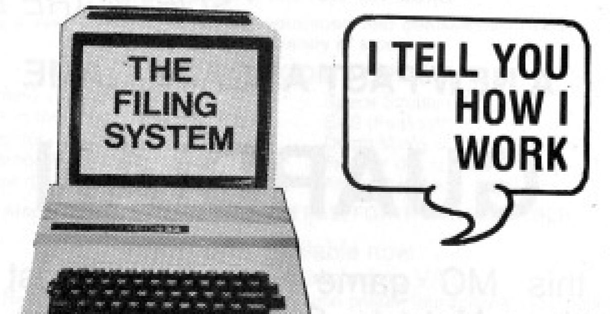
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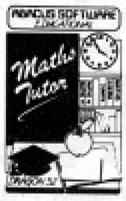
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Try the TV test

***Iolo ap Gwynn** explains how to test a television's suitability for use with your Dragon*

IT IS OFTEN very useful to have available a program which allows the display on the television screen of a set of patterns which will enable you to judge whether there is anything the matter with your set. This could be used when setting up a television which has not been used on your computer before, or, if you are so inclined, to service or adjust a set. An accompanying steady sound note is also useful in some cases such as when adjusting the tuner to optimise both sound and picture.

In writing this program I have attempted to provide as much useful information on the screen as possible. Three separate test screens are provided.

The first, on the text screen, is a colour bar chart on which the colours are identified by their name and number within the Dragon colour set.

The second testcard is put on to pages 1 to 4 of the graphics memory, and is used in the high resolution black and white PMODE4. This card consists of a central circle (permitting both vertical and horizontal linearity checks to be made) various black and white rectangles (in order to note the purity of the signal) and fine bars (to test the resolving power of the set).

Dragon's good design

This illustrates rather well how the Dragon has been designed to operate within the performance limits of the domestic television receiver which has a restricted ability to carry the higher resolution graphics images produced by computers. It is no use having a computer which has a higher number of pixels per line than a Dragon unless you are willing to go to the expense of buying a monitor as well.

The third test chart is put on pages 5 to 8 of the graphics memory and simply generates a "cross-hatch" pattern which can prove very useful in checking the correct adjustment of the colour convergence of earlier colour sets. It is also a severe test of whether a colour set will give an interference-free monochrome image.

Changing from one test chart to the next is effected by holding the space bar down until the required pattern appears.

The sound generating subroutine at line 940 is used also to check whether a key has been pressed so that the next chart in the sequence will appear. This subroutine is used in many places in the program.

The program will "hold" in line 70 showing the title page and sounding a steady note unless a key is pressed.

When the key is pressed for the first time lines 80 to 440 will begin assembling the colour bar chart. Once the "text" screen has been cleared in line 80 the chart is built up by POKEing the text screen memory locations rather than using ▶

```
10 PCLEAR 8
20 ' TEST CHARTS c I.ap GWYNN 7/83
30 CLS
40 PRINT@5*32+5,"TEST CHARTS WITH SOUND"
50 PRINT@10*32+5,"PRESS SPACE BAR TO CHANGE"
60 PRINT@14*32,"c I.ap GWYNN 7/83"
70 GOSUB 940
80 CLS
90 FOR X=0 TO 31
100 POKE 1024+X,198:POKE 1024+X+(15*32),198
110 NEXT
120 FOR Y=1 TO 14
130 POKE 1024+(Y*32),198:POKE 1024+(Y*32)+31,198
140 NEXT
150 X=-2
160 FOR I=1 TO 10
170 X=X+3
180 READ CO
190 FOR C=0 TO 2
200 FOR Y=1 TO 14
210 POKE 1024+(Y*32)+X+C,CO
220 NEXT Y,C,I
230 FOR X=1 TO 10
240 READ L,CS,CE
250 FOR C=CS TO CE
260 READ CH
270 POKE 1024+(C*32)+L,CH
280 NEXT C
290 READ NO
300 POKE 1024+(14*32)+L,NO
310 NEXT X
320 GOSUB 940
330 GOTO 450
340 DATA 128,191,255,159,143,175,223,239,207,128
350 DATA 2,4,9,3,15,12,15,21,18,48
360 DATA 5,1,3,18,5,4,52
370 DATA 8,1,6,15,18,1,14,7,5,56
380 DATA 11,1,6,25,5,12,12,15,23,50
390 DATA 14,1,5,71,82,69,69,78,49
400 DATA 17,1,4,2,12,21,5,51
410 DATA 20,1,4,3,25,1,14,54
420 DATA 23,1,7,13,1,7,5,14,20,1,55
430 DATA 26,1,4,2,21,6,6,53
440 DATA 29,6,8,2,1,18,48
450 PMODE 4,1:SCREEN 1,1:PCLS0
460 FOR X=0 TO 255 STEP 8
```

Continued on page 47

```
470 LINE(X,0)-(X+4,10),PSET,BF
480 LINE(X+4,0)-(X+8,10),PSET,B
490 LINE(X,181)-(X+4,191),PSET,BF
500 LINE(X+4,181)-(X+8,191),PSET,B
510 NEXT
520 FOR Y=10 TO 180 STEP 9
530 LINE(0,Y)-(10,Y+5),PSET,BF
540 LINE(245,Y)-(255,Y+5),PSET,BF
550 LINE(0,Y+5)-(10,Y+9),PSET,B
560 LINE(245,Y+5)-(255,Y+9),PSET,B
570 NEXT
580 CIRCLE(127,96),80
590 CIRCLE(127,96),79
600 LINE(127,80)-(127,112),PSET
610 LINE(111,96)-(143,96),PSET
620 FOR Y=20 TO 40 STEP 2
630 LINE(15,Y)-(30,Y+2),PSET,B
640 NEXT
650 FOR Y=40 TO 60 STEP 4
660 LINE(15,Y)-(30,Y+4),PSET,B
670 NEXT
680 LINE(215,15)-(230,96),PSET,B
690 LINE(215,96)-(230,170),PSET,BF
700 FOR X=15 TO 30 STEP 2
710 LINE(X,96)-(X,170),PSET
720 NEXT
730 LINE(80,120)-(127,130),PSET,BF
740 LINE(127,120)-(174,130),PSET,B
750 GOSUB 940
760 PMODE 4,5:SCREEN 1,1:PCLS
770 FOR X=0 TO 255 STEP 16
780 LINE(X,0)-(X,191),PSET
790 NEXT
800 FOR Y=0 TO 191 STEP 16
810 LINE(0,Y)-(255,Y),PSET
820 NEXT
830 GOSUB 940
840 SCREEN 0,1
850 FOR I=0 TO 1000:NEXT
860 GOSUB 940
870 PMODE 4,1:SCREEN 1,1
880 FOR I=0 TO 1000:NEXT
890 GOSUB 940
900 PMODE 4,5:SCREEN 1,1
910 FOR I=0 TO 1000:NEXT
920 GOSUB 940
930 GOTO 840
940 SOUND 89,50:Q$=INKEY$:IF Q$="" THEN 940
950 RETURN
```

◀ PRINT @ command. Using PRINT @ will not give the desired effect because it also changes the screen in all parts of a horizontal line following its execution.

The letters and numbers which appear on the colour bars are controlled by the information contained in the DATA statements in lines 340 to 440. You will notice that there are also inverse versions of numbers as well as letters available provided you POKE the correct value into a text memory location!

Lines 450 to 750 set up the chart with the circle on it. The circle is drawn twice, giving it the thickness of two lines. This makes it must easier to see. The limitation here again is set by the television receiver's restricted "bandwidth".

Good resolution test

The rectangle generated in lines 620 to 640 is a good test of the resolution of a television set. It should be a series of black and white lines, but in most of the sets I have tried it appears grey. This should be shown to anyone considering whether the higher resolution of an Electron is an advantage!

Lines 760 to 820 draw the cross-hatch pattern in steps of 16 pixels wide. When the cross-hatch has been generated then, on pressing a key, when subroutine line 940 is running in its loop, the screen will return to display the colour bar in the text screen memory.

The loop generated between lines 840 and 930 then ensures that the sequence of three test charts, with sound, will continue to appear every time a key is held down on the keyboard, a key being pressed every time it is required to move on to the next one. ■

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Solit

From K Spinner in Cleethorpes

THE RULES OF Solit are roughly the same as those of the famous puzzle Solitaire. You have 33 holes and 32 balls. The holes are arranged in a cross pattern and the balls go in the holes. The central hole is left empty.

A ball is removed if another is made to jump over it and into an empty hole. The object of the puzzle is to remove all of the balls apart from one which must be in the centre hole at the end.

Solit features some useful aids to solving this puzzle:

1. It can record at any time your current position and moves.
2. Using this recorded data you may update it with further moves and then resave it.
3. Or you may wish to review automatically all your moves up to this place.
4. During this review mode 'M' will return control to the keyboard and manual operation. This means that any recorded Solit data can be updated from any point up to the recorded position. This makes it possible to edit moves.

To move a ball, type in its co-ordinates pressing "Enter" after each one, then use an arrow key to give direction of jump, and press "Enter" again. Each operation can be changed by typing another key before "Enter" or by typing C.

C — Cancel move.
M — Manual mode.
S — Save position.
R — Restart position.

The computer then asks whether you wish to see any recorded data. If the answer is yes, then you can choose from three automatic modes:

1. Start in manual mode from recorded position.
2. Review all moves up to recorded position automatically.
3. Review all moves up to recorded position, (ENTERing each separate move yourself), with manual override.

Solutions to the puzzle can be obtained for £1.25 (including postage and packaging and cassette) by writing to: K. Spinner, 48 Aldrich Road, Cleethorpes, DN35 0DP.

```
10 CLEAR 1000:DIM IN$(100)
20 CLS:PRINT:IN$(57)="  SSS   OOO  L     IIIII TTTTTT":IN$(58)=" S   S O   O L
    I      T":IN$(59)="  S    O   O L      I       T":IN$(60)="   S   O   O L
    I      T":IN$(61)="    S  O   O L      I       T"
30 IN$(62)=" S   S O   O L      I       T":IN$(63)="  SSS   OOO  LLLLL IIIII
T":FORT=57TO 63:PRINT IN$(T):NEXT T
40 DIM M(2),MV(100),CH(10,10)
50 PRINT:PRINT" DO YOU WANT INSTRUCTION  (Y/N)"
60 IN$=INKEY$:IF IN$=""THEN 60
70 IF IN$<>"Y" THEN 190
80 PRINT@288," ******** INSTUCTIONS *********"
90 IN$(1)=" THE RULES OF SOLIT ARE ROUGHLY":IN$(2)=" THE SAME AS THAT OLD FAMOUS
":IN$(3)=" PUZZLE SOLITAIRE. YOU HAVE 32":IN$(4)=" BALLS AND 33 HOLES. THE HOLES
":IN$(5)=" ARE ARRANGED IN CROSS PATTERN,"
100 IN$(6)=" THE BALLS GO IN THE HOLES":IN$(7)=" THE CENTRAL HOLE IS LEFT EMPTY"
:IN$(8)=" A BALL IS REMOVED IF ANOTHER":IN$(9)=" IS MADE TO JUMP OVER IT AND":IN
$(10)=" INTO AN EMPTY HOLE. THE OBJECT":IN$(11)=" OF THE PUZZLE IS REMOVE ALL OF
"
110 IN$(12)=" THE BALLS APART FROM ONE WHICH":IN$(13)=" MUST BE IN THE CENTER HO
LE AT":IN$(14)=" THE END OF THE PUZZLE. ":IN$(15)=" ****************************
*":IN$(17)=" 'SOLIT' FEATURES SOME USEFULL":IN$(18)=" AIDS TO SOLVING THIS PUZZL
E :-"
120 IN$(20)=" 1  IT CAN RECORD AT ANY TIME":IN$(21)=" YOUR CURRENT POSITION & MO
VES":IN$(22)=" 2  USING THIS RECORDED DATA ":IN$(23)=" YOU MAY UPDATE IT WITH FU
RTHER":IN$(24)=" MOVES AND THEN RESAVE IT.":IN$(25)=" 3  OR YOU MAY WISH TO REVI
EW"
130 IN$(26)=" ALL YOUR MOVES UPTO THIS PLACE":IN$(27)=" ,(USE 'ENTER' FOR NEXT M
OVES)":IN$(29)=" 4  DURING THIS REVIEW MODE 'M'":IN$(30)=" WILL RETURN CONTROL B
ACK TO":IN$(31)=" KEYBOARD AND MANUAL OPERATION."
140 IN$(32)=" THIS MEANS THAT ANY RECORDED":IN$(33)=" 'SOLIT' DATA CAN BE UPDATE
D ":IN$(34)=" FROM ANY PLACE UPTO THE REC.":IN$(35)=" POSITION. THIS MAKES IT PO
S-":IN$(36)=" -SIBLE TO EDIT MOVES & PLACES":IN$(38)=" *************************
*****"
150 IN$(40)=" TO MOVE A BALL TYPE IN IT'S":IN$(41)=" COORDINATES PRESSING 'ENTER
```

```
'":IN$(42)=" AFTER EACH ONE, THEN PRESS AN":IN$(43)=" ARROW KEY FOR DIRECTION, T
HEN":IN$(44)=" 'ENTER'. EACH OPERATION CAN BE":IN$(45)=" CHANGED BY TYPING ANOTH
ER KEY"
160 IN$(46)=" BEFORE 'ENTER', OR TYPING 'C'":IN$(49)="       C ---- CANCEL MOVE":
IN$(50)="       M ---- MANUAL MODE":IN$(51)="       S ---- SAVE POSITION":IN$(52)=
"       R ---- RESTART GAME"
170 FORT=1TO 70:PRINT IN$(T)
180 FORD=1TO 1270:NEXT D,T
185 P$=INKEY$
190 PRINT@288," HAVE YOU ANY 'SOLIT' RECORDED"," DATA YOU WISH TO SEE   (Y/N)?"
200 L$=INKEY$:IF L$=""THEN 200
210 IF L$<>"Y" THEN 295
220 CLS:PRINT@34,"WHICH MODE DO YOU REQUIRE ?":PRINT@98,"1  START IN MANUAL MODE
 FROM"," RECORDED POSITION":PRINT:PRINT"  2  REVIEW ALL MOVES UPTO REC."," POS
ITION AUTOMATICALLY"
230 PRINT:PRINT"  3  REVIEW ALL MOVES UPTO REC."," POSITION (ENTERING MOVES YOU
R"," -SELF), WITH MANUAL OVERIDE"
240 PRINT@416,"":INPUT"  ENTER A NUMBER  (1-3)";R:AU$="Y"
250 IF R<>INT(R) OR R>3 OR R<1 THEN PRINT@474,"":GOTO 240
260 IF R>1 THEN AU$="Y2":GAP$="AUTO":IF R>2 THEN GAP$=""
270 PRINT:PRINT:PRINT"  INSERT CASSETTE, PRESS THE","    SPACE BAR WHEN READY"
280 IF INKEY$<>" "THEN 280
290 P$=INKEY$:GOSUB 1450
295 IF AU$=""THEN PRINT@457,"PLEASE WAIT"
300 DIM BA(2,2),BL(9,9),BOX(9,9)
310 DRAW"S8":N$(1)="BD1E1R2D4NR1L3BU4":N$(2)="BD1E1R2F1G3L1R4BU4BL4":N$(3)="BD1E
1R2D2NL1D2L2H1BU3":N$(4)="D2R3U2D4BL3BU4"
320 N$(5)="BR4L2G2R3F1D1L4BU4":N$(6)=N$(5)+"BD4U1BU3":N$(7)="BD1E1R3D1G3BL1BU4":
T$="C2R2ND6R2BR4R2F1D4G1L2H1U4E1"
330 PMODE1,1:PCLS1:COLOR2,2
340 CIRCLE(97,101),6,4:PAINT(97,101),4,4:GET(94,94)-(106,106),BA
350 PCLS1:REM END DEF. BALL
360 AR$(1)="L9D1R9D1L9D1R9L10D5NU13H1U11G1D9H1U7G1D5H1U3G1D1"
370 AR$(2)="BD1D1G1U3H1D5G1U7H1D9G1U11H1D13U5L10U1R9U1L9U1R9"
380 AR$(3)="BU6BL7L1G1R3F1L5G1R7F1L9G1R11F1L13R5D10R1U9R1D9R1U9"
390 AR$(4)="BD10BL7L1H1R3E1L5H1R7E1L9H1R11E1L13R5U10R1D9R1U9R1D9"
400 FORT=0TO 7:LINE(6,12+22*T)-(174,12+22*T),PSET:LINE(6+24*T,12)-(6+24*T,166),P
SET:NEXT T
410 FORX=0TO 120 STEP 120:FORY=0TO 120 STEP 120
420 FORD=1TO 2:FORT=1TO 2
430 PX=24*T+X:PY=22*D+Y
440 PAINT(PX,PY),2,2:NEXTT,D,Y,X
450 PUT(0,176)-(250,190),BL
460 SCREEN 1,0:IF AU$<>"Y" THEN NU=0
470 IF AU$="Y"THEN GOSUB 1530:GOTO 570
480 FORT=0TO 6:FORB=0TO 2
490 BX=62+24*B:BY=16+22*T
500 IF T=3 AND B=1 THEN PUT(BX,BY)-(BX+12,BY+12),BL:NEXT B,T
510 PUT(BX,BY)-(BX+12,BY+12),BA
520 IFT=2 ORT=3 ORT=4 THEN GOSUB 540
530 NEXT B,T:GOTO 570
540 FORG=0TO 1:BX=14+24*G:PUT(BX,BY)-(BX+12,BY+12),BA:NEXT G
550 FORG=0TO 1:BX=134+24*G: PUT(BX,BY)-(BX+12,BY+12),BA:NEXT
560 RETURN
570 DRAW"BM12,0":FORT=1TO 7
580 DRAW N$(T)+"BR12":NEXT T
590 DRAW"BM184,18":FORT=1TO 7
600 DRAW N$(T)+"BD11":NEXT T
610 COLOR 4,4:LINE(206,12)-(246,64),PSET,B:LINE(206,114)-(246,166),PSET,B:DRAW"B
M214,86"+T$
620 GET(206,114)-(246,166),BOX
630 L$=INKEY$:IF L$="" AND AU$<>"Y2"THEN 630
640 IF AU$="Y2"THEN L$=CHR$(13)
650 IF L$="M" OR K$="M" THEN AU$="":GOTO 630
660 IF L$="S" THEN SOUND 170,1:GOSUB 1260
670 IF TY=0 ANDAU$="Y2" THEN M=0
680 IF L$="R" THEN HH=0:H=0:GOTO 450
690 IF L$="C" AND AU$<>"Y2"THEN:I=0:GOTO 730
700 IF AU$<>"Y2" AND ASC(L$)=13 AND L>0 THEN SOUND 170,1:I=I+1:M(I)=L:M=20:IF I>
1 THEN 800 ELSE GOTO 630
```

```
710 IF AU$<>"Y2" THEN L=VAL(L$):IF L>7 OR L<1 THENSOUND 1,5:L=0:GOTO 630
720 IFAU$="Y2" THEN HH=HH+1:TY=TY+1:L=MV(HH):L$=CHR$(13):M(TY)=L
730 PUT(208,14+M)-(236,40+M),BL
740 IF L$="C" AND M=0 AND AU$<>"Y2" THEN GOSUB950:I=0:GOTO 630
750 IF L$="C" AND AU$<>"Y2"THEN M=0:GOTO 730
760 DRAW "C2BM218,16S16":IF M=20 THEN DRAW"S8BM218,42S16"
770 DRAW N$(L):IF AU$<>"Y2" THENGOTO 630 ELSE M=20
780 SOUND 170,1:IF TY>1 THEN 800
790 K$=INKEY$:GOTO 650
800 L$="E":YT=2:BX=-10+24*M(1):BY=-6+22*M(2)
810 IF PPOINT(BX+6,BY+6)=2 OR PPOINT(BX+6,BY+6)=1 THEN SOUND 1,5:I=0:L$="C":GOTO
 730
820 PUT(BX,BY)-(BX+12,BY+12),BL:GOSUB 870
830 PUT(BX,BY)-(BX+12,BY+12),BA:IF AU$<>"Y2" THEN L$=INKEY$
840 IF O=2 THEN GOTO 1040
850 IF OO=2 THEN HH=HH-3:AU$="":OO=0:L$="C":K$=""
860 IF L$="C"  THEN 730 ELSE 820
870 IF L$="" THEN FORT=1TO 15:NEXT T:RETURN
880 IF ASC(L$)=13 AND O=1 THEN O=2:SOUND 170,1:RETURN
890 MO=ASC(L$):IF AU$="Y2" AND YT=2 THEN HH=HH+1:MO=MV(HH)
900 IF MO=8 THEN NO=1:O=1 ELSE IF MO=9 THEN NO=2:O=1
910 IF MO=94 THEN NO=3:O=1
920 IF MO=10 THEN NO=4:O=1
930 IF O=0 THEN RETURN
940 IF YT=0 THEN 980
950 PUT(206,114)-(246,166),BOX
960 IF L$="C" THEN O=0:RETURN
970 DRAW"S8BM242,136"+AR$(NO)
980 YT=0:IF AU$<>"Y2"THEN RETURN
990 K$=INKEY$:IFK$="" AND GAP$="" THEN RETURN ELSE IF GAP$="AUTO" THEN 1030
1000 IF K$="M" AND GAP$="" THEN OO=2:RETURN
1020 IF ASC(K$)<>13 THEN RETURN
1030 SOUND 170,1
1040 TY=0:IF AU$<>"Y2" THEN HH=HH+1:MV(HH)=M(1):HH=HH+1:MV(HH)=M(2):HH=HH+1:MV(H
H)=MO:L=0
1050 ON NO GOTO 1140,1100,1060,1180
1060 IF PPOINT(BX+6,BY-18)<>4 THEN SOUND 1,5:L$="C":GOTO 1580
1070 IF PPOINT(BX+6,BY-40)<>1 THEN SOUND 1,5:L$="C":GOTO 1580
1080 PUT(BX,BY)-(BX+12,BY+12),BL
1090 PUT(BX,BY-44)-(BX+12,BY-32),BA:PUT(BX,BY-22)-(BX+12,BY-10),BL:GOTO 1220
1100 IF PPOINT(BX+30,BY+6)<>4 THEN SOUND 1,5:L$="C":GOTO 1580
1110 IF PPOINT(BX+52,BY+6)<>1 THEN SOUND 1,5:L$="C":GOTO 1580
1120 PUT(BX,BY)-(BX+12,BY+12),BL
1130 PUT(BX+48,BY)-(BX+60,BY+12),BA:PUT(BX+24,BY)-(BX+36,BY+12),BL:GOTO 1220
1140 IF PPOINT(BX-18,BY+6)<>4 THEN SOUND 1,5:L$="C":GOTO 1580
1150 IF PPOINT(BX-42,BY+6)<>1 THEN SOUND 1,5:L$="C":GOTO 1580
1160 PUT(BX,BY)-(BX+12,BY+12),BL
1170 PUT(BX-48,BY)-(BX-36,BY+12),BA:PUT(BX-24,BY)-(BX-12,BY+12),BL:GOTO 1220
1180 IF PPOINT(BX+6,BY+28)<>4 THEN SOUND 1,5:L$="C":GOTO 1580
1190 IF PPOINT(BX+6,BY+50)<>1 THEN SOUND 1,5:L$="C":GOTO 1580
1200 PUT(BX,BY)-(BX+12,BY+12),BL
1210 PUT(BX,BY+44)-(BX+12,BY+56),BA:PUT(BX,BY+22)-(BX+12,BY+34),BL
1220 NU=NU+1:KX=-6+8*NU:L$="C"
1225 IF NU=31 THEN FORG=1TO 4:FORT=1TO 7:PP=-20*(T>4):SOUND 130+10*T+PP,1:PP=0:N
EXT T,G:IF AU$="" AND H<24 THEN PRINT" WHAT A WIZ KID!!, YOU SHOULD"," TAKE THIS
 UP FOR A LIVING!!":PRINT:PRINT" DO YOU WANT TO RECORD   (Y/N)":GOTO 1270
1230 PUT(KX,178)-(KX+12,190),BA
1240 IF HH/3=H THEN AU$=""
1250 GOTO 730
1260 SCREEN 0,0:CLS:PRINT"      ARE YOU SURE ?      (Y/N)"
1270 S$=INKEY$:IF S$=""THEN 1270
1280 IF S$<>"Y" THEN SCREEN 1,0:RETURN ELSE CLS
1290 FORT=0TO 6:FORG=0TO 6
1300 CX=18+24*G:CY=22+22*T
1305 CH(G,T)=0
1310 IF PPOINT(CX,CY)=1 OR PPOINT(CX,CY)=2 THEN CH(G,T)=1
1320 NEXT G,T
1330 CLS:PRINT:PRINT" SAVING NOW READY TO COMMENCE."," ALL ESSENTIAL DATA CONSTR
UCTED":PRINT
1340 PRINT" PRESS BOTH 'REC' AND 'PLAY' ON"," CASSETTE. PRESS SPACE TO BEGIN"
```

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```
1350 IF PEEK(345)<>223 THEN 1350
1360 OPEN "O",£-1,"SOLIT"
1370 FORT=OTO 6:FORG=OTO 6
1380 PRINT £-1,CH(G,T):NEXT G,T
1390 PRINT £-1,NU:PRINT £-1,HH
1400 FORT=1TO HH:PRINT £-1,MV(T)
1410 NEXT:CLOSE £-1:K$=INKEY$
1420 CLS:PRINT:PRINT" TO RETURN TO THE GAME PRESS R"
1430 S$=INKEY$:IF S$=""THEN 1430
1440 IF S$="R" THEN SCREEN 1,0:RETURN ELSE CLS:END
1450 '
1455 OPEN "I", £-1, "SOLIT"
1460 FORT=OTO 6:FORG=OTO 6
1470 INPUT£-1,CH(G,T):NEXT G,T
1480 INPUT£-1,NU: INPUT£-1,HH
1490 FORT=1TO HH: INPUT£-1,MV(T)
1500 H=HH/3
1510 NEXT:IF AU$="Y2" THEN HH=0
1520 CLOSE£-1:GOTO 300
1530 FORT=OTO 6:FORG=OTO 6
1540 IF CH(G,T)=1 THEN NEXT G,T ELSE RX=14+24*G:RY=16+22*T:PUT(RX,RY)-(RX+12,RY+
12),BA:NEXT G,T
1550 FORT=1TO NU:LX=-6+8*T
1560 PUT(LX,178)-(LX+12,190),BA
1570 NEXT T:RETURN
1580 HH=HH-3:GOTO 730
```

Waves

From A Evans of Warwick

THIS PROGRAM WILL display any combination of sine and cosine waves. The number of cycles can be altered and waves can be mixed with other waves.

Program notes

5-70	Enters data about waves.
80-90	Draws axis.
100-160	Decides which wave to draw and works out Y co-ordinate according to number of cycles and wave type.
170-180	Returns to text when key pressed and asks whether to mix next wave or clear the screen.

```
5 PCLS
10 CLS:PRINT"                WAVES":PRINT"                =====":PRINT:PRINT"THIS PROGRA
M WILL PRODUCE SINE  AND COSINE WAVES"
20 PRINT
30 INPUT"DO YOU WANT A SINE (S) OR A      COSINE (C) WAVE";S$
40 PRINT
50 INPUT "HOW MANY CYCLES DO YOU WANT";W:W=W*(360/255)
60 PRINT:IF S$="S" THEN PRINT "DO YOU WANT THE WAVE TO BE A    MINUS WAVE (START
 HEADING DOWN) Y/N":INPUT U$
70 CLS:PRINT@226,"PRESS ANY KEY WHEN FINISHED":FOR R=1 TO1000:NEXT
80 PMODE 4,1:SCREEN 1,0
90 LINE (1,2)-(1,189),PSET:LINE(1,96)-(255,96),PSET:FOR A=64 TO 255 STEP 64:LINE
 (A,93)-(A,99),PSET:NEXT A
100 A=3.1415/180
110 FOR I=1 TO 255
120 IF S$="S"THEN 130 ELSE B=I*W*A:C=COS(B)*96+96:GOTO 150
130 B=I*W*A:C=SIN(B)*96+96
140 IF U$="N"THEN 150 ELSE PSET(I,C,1):GOTO 160
150 PSET (I,192-C,1)
160 NEXT 1
170 IF INKEY$="" THEN 170 ELSE GOTO 180
180 CLS:SCREEN 0,0:PRINT"DO YOU WANT TO MIX THE NEXT WAVEWITH THE LAST ONE OR CL
EAR THE  SCREEN (MIX OR CLS)":INPUT M$:IF M$="MIX" THEN GOTO 10 ELSE RUN
```

Screen print

From A Evans in Warwick

THIS PROGRAM WAS written for a Dragon 32 + Tandy DMP 100 printer, but it can be easily converted for use on other graphic printers. It takes just over 15 minutes to copy any hi-res screen on to paper. This time can be cut if your printer will work with the POKE 65495,0. If it can, then insert a line: 95 POKE 65495,0.

As with most printers, the DMP 100 uses a 5x7 pin printing head. It prints its graphic patterns on a 1x7 grid in a binary formation — eg, 1100001 = one dot at the top and two dots at the bottom (rightmost digit at top). The Chr code for this formation is formed by finding the decimal value of the graphic pattern and adding 128. For example 1100001 = 97 dec and 97 + 128 = 225 dec (Chr code for graphic pattern with one dot at the top and two dots at the bottom).

In this program the computer checks the screen using PPOINT and if the pixel is on any colour except black it will print the appropriate dot — according to a counter (A). Once the computer has checked 256 pixels both A and Y (variable used for the next PPOINT check) are incremented and the whole process starts again on the next column down, until Y = 191 and the printed copy is finished. Every seven columns, when loop A ends, the printer will line feed and start printing the next seven columns.

The seven codes at lines 200-260 are the codes for one dot in top column, one dot in second from top column, and so on.

Other Chr codes are as follows:

100 — Designate graphic mode.
120 — Line feed. Advance paper one line.
140 — Repeats the Chr code 128 (space) Z times (tabulating picture position).
180 — Prints a space if the pixel is not lit.
190 — Prints buffer and carriage return. Next Chr will be printed on the same line.
270 — Returns printer to normal printing mode.

Program notes

10-40	Introduction, position of printed copy.
50	Tabulate picture according to Z$ (picture position).
60-80	Printer preparation.
90	Display hi-res screen.
100	Put printer into graphics mode.
120	Empties buffer.
130	Set loop A.
140	Tabulate picture (left/middle/right).
150-160	Increment Y; check for end of screen.

170-190	Set loop for X. Check pixel X,Y and if lit GOSUB appropriate line and print appropriate dot according to A, ELSE print a space. Repeat seven times without line feed, then line feed and start again.
200-260	Graphic Chrs for one dot at the top etc.
270	Return to normal printer mode and RE-RUN program.

The progam is relatively easy to operate as nothing too technical is required. Once the program has been typed in, check it through and save it normally in a place where it can easily be accessed.

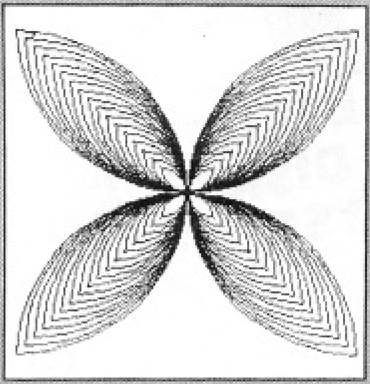
NEW any existing programs, then LOAD in a program which produces a hi-res display (PMODE 2, 3 or 4). RUN the program and break it when the desired display is reached. (The picture is still in the memory even in text mode).

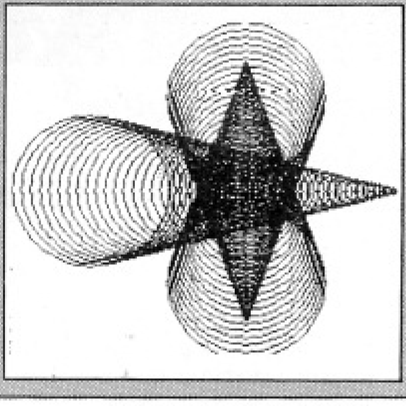
LOAD and RUN the SCREEN PRINT program. When the computer asks you where you want the picture you should reply with L, M or R; any other reply will be rejected.

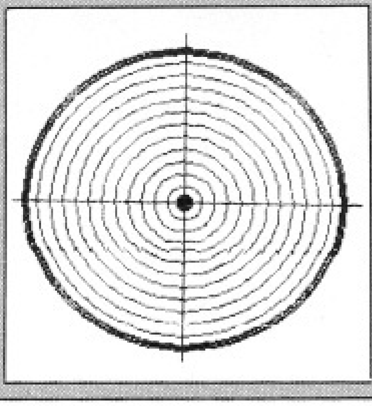
After preparing the printer, press any key. The hi-res picture should be displayed and the printer should, every four or five seconds, print one line of the hi-res screen (if there is anything to print). If nothing happens, break the program and check it through again.

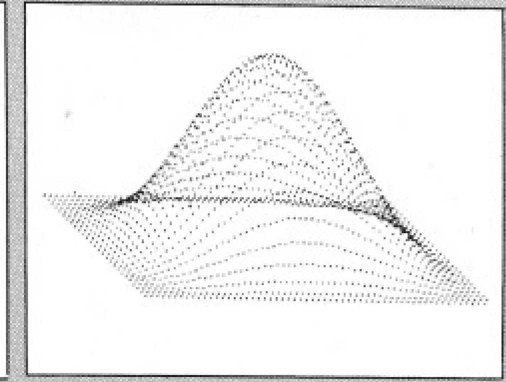
When the program has finished printing, the display will return to text and ask you if you want another copy.

The inverse of a picture can be obtained by changing the <> sign on line 180 to =.









```
10 CLS:PRINT"          SCREEN PRINT":PRINT"          ============="
20 PRINT:PRINT"THIS PROGRAM WILL COPY A HI-RES SCREEN ONTO PAPER":PRINT
30 PRINT"WHERE DO YOU WANT THE PICTURE   PRINTED ON THE PAPER?
                          left     middle     right"
40 PRINT:PRINT@384,"L/M/R";:INPUTZ$
50 IFZ$="L"THENZ=1ELSEIFZ$="M"THENZ=112ELSEIFZ$="R"THEN Z=224ELSEGOTO 40
60 PRINT
70 PRINT@419,"PREPARE PRINTER THEN PRESS                   ANY KEY"
80 IF INKEY$=""THEN80
90 PMODE4,1:SCREEN 1,0
100 PRINT#-2,CHR$(18);
110 Y=-1
120 PRINT#-2,CHR$(10);
130 FOR A=1 TO 7
140 PRINT#-2,CHR$(28);CHR$(Z);CHR$(128);
150 Y=Y+1
160 IF Y=192 THEN 270
170 FOR X=0 TO 255
180 IF PPOINT(X,Y)<>0 THEN ON A GOSUB 200,210,220,230,240,250,260 ELSEPRINT#-2,C
HR$(128);
190 NEXT X:PRINT#-2,CHR$(26);:NEXTA:GOTO 120
200 PRINT#-2,CHR$(129);:RETURN:REM 0000001
210 PRINT#-2,CHR$(130);:RETURN:REM 0000010
220 PRINT#-2,CHR$(132);:RETURN:REM 0000100
230 PRINT#-2,CHR$(136);:RETURN:REM 0001000
240 PRINT#-2,CHR$(144);:RETURN:REM 0010000
250 PRINT#-2,CHR$(160);:RETURN:REM 0100000
260 PRINT#-2,CHR$(192);:RETURN:REM 1000000
270 PRINT#-2,CHR$(30):SCREEN0,1:CLS:PRINT@260,"DO YOU WANT ANOTHER COPY?":INPUT
"          Y/N";V$:IF V$="Y"THEN 10 ELSE IF V$="N" THEN END ELSE 270
```

Martian landings

From C Garrington in Wales

THE OBJECT OF this game is to safely land your three supply pods on the surface of Mars. There is a strong gravitational pull from the nearby moon of Endor which diverts your craft towards the left. At the beginning of your mission you have 75 units of energy, one of which is used with each thrust of your retro-rockets. The rockets are controlled with the "up" and "right" arrow keys.

If you fail to land your pod safely on a yellow landing pad it will explode and the explosion will destroy the pod and all the surrounding landscape within range. If you do manage to safely land your pod you will be rewarded with musical tones.

Program notes

60-130	Draw pod; check for instructions.
140-200	Draw landscape; put pod in co-ordinates.
210-340	Calculate descent; check for pod movement; check for landing or crash.
350-840	Appropriate subroutines (crash pod, land pod etc).
850-950	Instructions.

Variables

Z — Horizontal location of pod.
X — Vertical location of pod.
FUEL — Number of fuel units left.
SHIP — Number of ships left.
SCOR — Number of ships safely landed.

All subroutines are clearly marked with REM statements.

```
10 REM****************************
20 REM***MARTIAN LANDINGS******
30 REM***BY C.GARRINGTON*******
40 REM****17/8/83***************
50 REM****************************

60 GOSUB 960
70 CLS:PRINT@0,"        MARTIAN LANDINGS"
80 PRINT@224,"":INPUT"DO YOU NEED INSTRUCTIONS";H$
90 IF LEFT$(H$,1)="Y"THEN GOSUB 850
100 CLS:PRINT@224,"":INPUT"DO YOU WANT A FAST OR SLOW GAME";E$
110 IF LEFT$(E$,1)="F"THEN E=50
120 IF LEFT$(E$,1)="S"THEN E=100
130 Z=200:X=10:T=50:V=50:FUEL=75:SHIP=3:SCOR=0
140 PMODE 3,1:PCLS:DRAW"BM0,170;E10;F5;R15;U2;C2;L20;C4;D2;R20F4;E15;F10;R30U2C2
L30C4D2R30;U10;E5;F10;E15;F6;E10;R20;U2;C2;L20;C4;D2;R30U2C2L30C4D2R30;E12;F15;E
3;U7;E5;F8;E10;F19;E4;U6;R10;E4;F7;E10"
150 CIRCLE(50,50),30,4
160 PAINT(50,51),2,4
170 PAINT(0,190),3,4
180 SCREEN 1,0
190 PUT(Z,X)-(Z+20,X+20),P,PSET
200 A$=INKEY$
210 REM***RANDOM DECENT********
220 Z=Z-(RND(4)-1):X=X+(RND(4)-1)
230 FORT=1 TO E:NEXT T
240 A$=INKEY$
250 REM***MOVEMENT OF POD******
260 IF A$=CHR$(9) THEN GOSUB 350
270 IF A$=CHR$(94) THEN GOSUB 420
280 IF PPOINT(Z,X+20)>2 THEN GOSUB 490
290 IF PPOINT(Z+20,X+20)>2 THEN GOSUB 490
300 IF PPOINT(Z,X+20)=2 THEN GOSUB 620
310 IF PPOINT(Z+20,X+20)=2 THEN GOSUB 620
320 IF PPOINT(Z,X)>2 THEN GOSUB 490
330 IF PPOINT(Z+20,X)>2 THEN GOSUB 490
340 GOTO 190
350 REM****MOVE POD**********
360 Z=Z+4
370 FUEL=FUEL-1
380 IF FUEL<5 THEN 740
390 REM****END OF ROUTINE****
400 PLAY"O1;T250;AAAAAAAAAAAA"
410 RETURN
420 REM***MOVE POD************
430 Z=Z-1:X=X-3
440 FUEL=FUEL-1:IF FUEL<0 THEN 740
450 PLAY"O2;T250;AAAAAAAAAAAAAAA"
460 RETURN
470 REM***END OF ROUTINE******
480 REM****CRASH POD ROUTINE**
490 PLAY"T250;O5AAAAAAAAAAAAAO4AAAAAAAAAAAAAAO3AAAAAAAAAAAAAAAAO2AAAAAAAAAAAAAA
AAO1AAAAAAAAAAA"
500 FORQ=1 TO 30
510 CIRCLE(Z+10,X+10),Q,4
520 NEXT Q
530 FORQ=1 TO 30
540 CIRCLE(Z+10,X+10),Q,1
550 NEXT Q
560 SHIP=SHIP-1:IF SHIP=0 THEN 680
570 FOR T=1 TO 500:NEXT
580 Z=200:X=0:S=S+1
590 RETURN
600 REM***END OF ROUTINE****
610 REM******LAND POD ROUTINE*
620 PLAY"T250;O1AGAGAGAGGGGAAGAGAGAGO2AGAGAGAGAGGAGAGAGAGO3AGAGGGGGAAGAGAO4A
GAGAGAGAGAGGGAO5AGAGAGAGAGAG"
630 SCOR=SCOR+1
640 Z=200:X=10
650 SHIP=SHIP-1:IF SHIP=0 THEN 680
```

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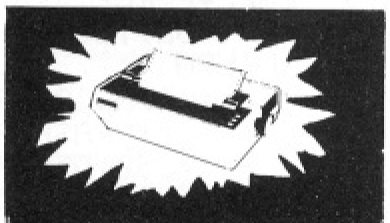
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COMPWARE

GRAPHIPRINT high resolution print routine allows normal use of Basic, text in any colour, double height, width, etc. User manual included, £9.95. Edit-32 program, text and file editor includes replace, kill, search, copy, insert and many other features. User manual included, £9.95. SAE for games and utilities list to: Willow Software, Willow Bank, Ilston, Swansea SA2 7LD.

Here's my classified ad.

(Please write your copy in capital letters on the lines below.)

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I make this .... words, at 20p per word so I owe you £ ....

Name ....

Address...

....

....

Telephone ....

Please cut out and send this form to: Classified Department, *Dragon User*, Hobhouse Court, 19 Whitcomb Street, London WC2

```
660 GOTO 190
670 REM***END OF ROUTINE*******
680 CLS:PRINT
690 PRINT"YOU MANAGED TO LAND, "SCOR" OUT OF YOUR 3 SHIPS"
700 PRINT"YOU HAVE "FUEL" UNITS OF FUEL LEFT"
710 FORT=1 TO 1000:NEXT T
720 PRINT@448,"":INPUT"ANOTHER GAME (Y/N)";F$
730 IF F$="N"THEN END ELSE 70
740 PLAY"T250;O5AAAAAAAAAAAAAAO1AAAAAAAAAAAAAAAO5AAAAAAAAAAAAAAO1AAAAAAAAAAAAAAA
"
750 IF FUEL<0 THEN 760 ELSE RETURN
760 SHIP=SHIP-1:IF SHIP=0 THEN 680
770 FORQ=1 TO 30
780 CIRCLE(Z+10,X+10),Q,4
790 NEXT Q
800 FORQ=1 TO 30
810 CIRCLE(Z+10,X+10),Q,1
820 NEXT Q
830 Z=200:X=10
840 RETURN
850 CLS:PRINT@0,"                MARTIAN LANDINGS"
860 PRINT"THE OBJECT OF THE GAME IS TO    LAND THREE SUPLY PODS ONTO THE  MARTIA
N LANDSCAPE.THER ARE        THREE LANDING PADS ON THE         SURFACE.YOU START THR
GAME WITH 75 UNITS OF FUEL ONE IS USED    WITH EACH RETRO THRUST."
870 PRINT"THE THRUSTS ARE CONTOLLED WITH  THE 'UP' AND 'RIGHT' ARROW KEYS"
880 PRINT"THE PODS USE NEUCLEAR FUEL  AND TOO ROUGH A LANDING WILL CAUSE IT TO E
XPLODE.THE DEBRIS  FROM THE EXPLOSIONS WILL REMAIN UNTIL  A NEW GAME IS STARTED.
"
890 PRINT@480,"PRESS A KEY TO CONTINUE"
900 IF INKEY$=""THEN 900
910 CLS:PRINT"IF YOUR FUEL LEVELS GET          DANGEROUSLY LOW YOU WILL          RE
CIEVE A WARNING SIGNAL.THIS   MEANS YOU ONLY HAVE A VERY        SMALL AMOUNT OF FU
EL LEFT.IF    THE FUEL SUPPLY IS OVER-USED     IT WILL CAUSE A NEUCLEAR          RE
ACTION."
920 PRINT"WHICH WILL DESTROY YOUR POD."
930 PRINT:PRINT:PRINT"PRESS A KEY TO START"
940 IF INKEY$=""THEN 940 ELSE RETURN
950 GOTO 950
960 PMODE 3,1:PCLS
970 DIMP(20,20)
980 CIRCLE(11,13),5,2
990 DRAW"BM8,15;G2;BM12,15;F2"
1000 GET(0,0)-(20,20),P,G
1010 PCLS:RETURN
```

HCF/LCM

From D. Prins in Liverpool

THIS PROGRAM PRINTS the highest common factor (hcf) and lowest common multiple (lcm) of any two given positive whole numbers using Euclid's algorithm for the calculation.

Program notes

60-80	Input the two numbers.
90	Check that they are positive integers.
100-120	Calculate the hcf.
130	Print the hcf.
140	Calculate and print the 1cm.
150-170	See if another evaluation is required.

Variables

I,J — The two numbers.
A,B,R — Used to calculate the hcf. B finally holds the value of the hcf.
A$ — Holds result of INKEY$.

```
10 REM FINDING THE HIGHEST
20 REM COMMON FACTOR
30 REM AND LOWEST COMMON MULTIPLE
40 REM OF TWO POSITIVE INTEGERS
50 REM
60 CLS:PRINT"ENTER THE TWO NUMBERS"
70 PRINT"SEPARATED BY COMMAS";
80 INPUT I,J
90 IF I<1 OR J<1 OR I<>INT(I) OR J<>INT(J)
   THEN PRINT"POSITIVE INTEGERS PLEASE";:
   GOTO 80
100 A=I:B=J
110 R=B-INT(B/A)*A:B=A:A=R
120 IF R>0 THEN 110
130 PRINT"HIGHEST COMMON FACTOR   IS":B
140 PRINT"LOWEST  COMMON MULTIPLE IS";I*J/B
150 PRINT:PRINT"MORE NUMBERS? (Y/N)"
160 A$=INKEY$:IF A$="" THEN 160
170 IF A$="Y" THEN 60 ELSE IF A$="N"
    THEN STOP ELSE 160
```

Dragon Answers

If you've got a technical question or problem write to Brian Cadge, Dragon Answers, *Dragon User*, 12/13 Little Newport Street, London WC2R 3LD.

Random(?) numbers

A FRIEND at work recently tried — and failed — to win a car at a fairground throwing six sixes with six dice at the same time. I thought I would try this particular "game" out on my Dragon 32 using an array containing six random numbers. Each time I ran it (three times), it gave the same result.

Does this mean that the random generator is not truly random or am I into the realms of very improbable probability theory?

S McGiveron,
Guildford,
Surrey.

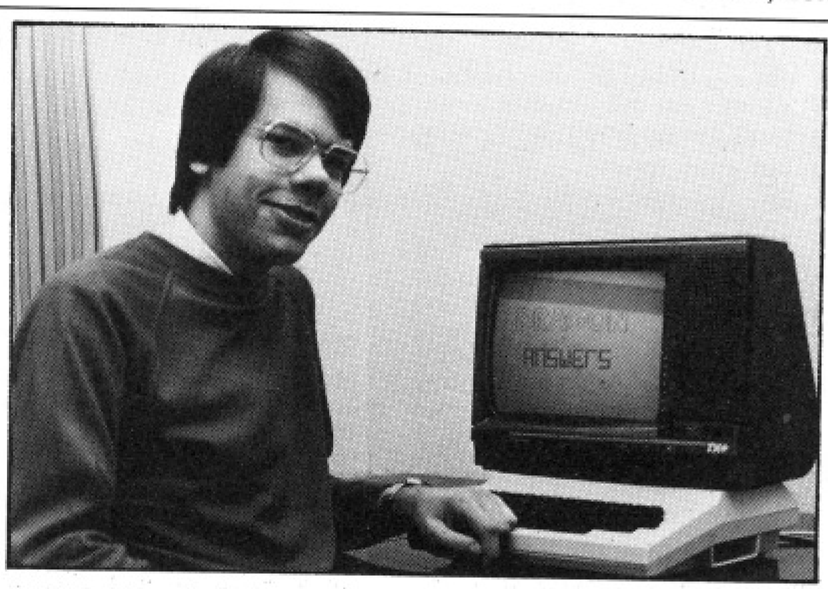
MOST MICROS use a mathematical algorithm to produce random numbers by means of software. This technique uses "seeds" which are taken and processed by the routine and then stored back as new seeds producing a random number in the process. These seeds are stored in locations 278 to 281 on the Dragon. The results are not truly random but give a repeating cycle of so-called random numbers which is so long as to usually appear random. In a program such as yours where so many random numbers are used, the whole cycle is used up and repeated and so you will get the same result each time.

To set the seeds in a program so that the same random numbers are used each time the program is run, you give the RND argument a negative value — eg A = RND (−99). To achieve a RANDOMIZE feature on the Dragon, the best way is to use A = RND (−TIMER), this uses a random number (the value of Timer) to set the random number seeds — you can't get any more random than that without hardware!

Pound problem

I HAVE had a Dragon 32 computer for two months now and I keep finding a small pound sign (£) in the listings of some programs. Could you please tell me the significance of this and how to obtain it on the Dragon 32.

B Allison,
Louth.



THERE IS a simple answer to this one. The ASCII code for a hash (#) is 35. You get this using Shift and 3 together and it is used mainly in Print and Input statements.

Some printers have a British version of the ASCII character set where the hash sign has been replaced by a pound sign. Therefore, whenever you read '£' in a program listing for the Dragon, enter a hash symbol and all will work well.

A Dragon in Aussie

COULD YOU please tell me whether my Dragon 32 will be compatible with the Australian electrical currency? I am emigrating to South Australia soon, and would be sad to have to sell my Dragon.

I know Tandy computers are sold in "Aussie" but I haven't yet heard whether the Dragon or its software is available there.

S Humphreys,
Chester.

THE AUSTRALIAN TV system is the same as ours as far as the picture goes, that is to say the PAL system. Therefore, I can see no problems with using your Dragon "Down Under", except that the Dragon's sound output will not be compatible with their system.

You can easily overcome this by either taking the sound output from the cassette socket or the monitor socket through an amplifier.

As the Dragon becomes more popular abroad, you should find more and more software easily available for it. Whether the Dragon will be sold in Australia is not certain.

Error mysteries

ONE DAY when I was playing about on my Dragon 32 I came across a ?NE ERROR when using EXEC. I looked it up in the manual as I have never come across it before and found that it wasn't there. Could you please explain what this error is?

C Leeds,
Plymouth,
Devon.

THERE HAVE been a number of letters regarding unknown error codes which keep appearing, especially when using EXEC. Those such as ?JF ERROR are not true error messages, but are caused by jumping into the Dragon's error handler routine using EXEC. The 6809 'B' register holds the error code, if this is higher than 52 then you will get a garbage error — one that doesn't really exist.

There are, however, three error codes which do exist and which are not mentioned in the Basic manual. ?UF means undefined function — trying to use FNA (8) without DEF FNA(X) = . . . first ?DN stands for Device Number — when the device number (that which follows '#' in Print, Open etc) is not 0, −1 or −2. Finally, the error code mentioned in this letter, ?NE — with normal Basic this means 'non existent error' (ie, an unknown error); with disk Basic working it means 'file non-existent on disk' and the original meaning has been replaced by ??? ERROR. You should never usually get an NE error from normal Basic use and if you do the cause should be investigated.

A suitable recorder

I HAVE a Dragon computer and want to buy a cassette player to use with it. Could you please recommend the most suitable?

P Blagdell,
Westerham,
Kent.

THEORETICALLY ANY good quality cassette recorder with sockets for EAR, MIC or better still AUX, and REM for remote control will work with the Dragon. Often the cheaper recorders will work more reliably than expensive ones — because the "tinnier" the output, the better for computers.

In practice, of course, not all recorders which are said to be "computer compatible" will give 100 per cent reliability, as I know to my cost. The most reliable (and expensive!) cassette I found, and the one I usually use is the Tandy CCR-81. This was designed for use with the Tandy Colour Computer — and we all know the similarities between this and the Dragon. Another good point is that you get a spare lead which will work with the Dragon. As I said, this is rather expensive at about £40, but is the most reliable I know of.

Correction

IN THE November issue of *Dragon User*, I answered a question from Mr Sear of Yeovil regarding connection of a Dragon to a caravan power supply. My answer seems to have caused some confusion so I would like to clarify it.

The Dragon requires two power inputs as I stated — 12V and 5V (or four inputs if you regard them as +12, −12, +5, −5). The battery's 12V can be used directly by bypassing the regulator. To obtain the 5V supply I suggested a transformer could be used on the 12V supply. This should have read: "a dropping resistor of the correct value and wattage could be used on the 12V supply and an invertor to obtain the −5V."

Perhaps the safest and simplest solution would be to wire the caravan for 230V AC using a 25W inverter off the battery, so that the normal Dragon power supply could still be used.

Competition Corner

Answers to Competition Corner, *Dragon User*, 12/13 Little Newport Street, London WC2R 3LD

A full library

*To win Dragon Data's complete range of software, 70 titles in all, you must name an imaginary small business computer and solve the puzzle (with **Gordon Lee's** advice)*

DRAGON, VIC20, Sinclair Spectrum and Oric are names of home computers that are recognised around the world. Could you think of a name that will become equally as famous?

This month we want you to name an imaginary small business computer to be launched in 1984 and then solve the puzzle below. The winner will receive the entire Dragon software list for the 32 — 70 titles in all.

Hint: Don't forget that many leading computer manufacturers release a series of small business computers under one name, so whatever name you think of must be capable of expansion. For example, if you were to call the computer "Gamma" then the series could be identified as "Gamma 1" and "Gamma 2" and so on. However, let your imagination run free. Who knows, if you think of a good enough name we might be able to persuade Dragon Data to use it themselves.

But just how good is your ability as a puzzlist? How do you go about working out a solution if you find a particularly hard nut to crack? Primarily, you may find that you must adopt many kinds of approach to finish with a satisfactory solution, a solution which might call for a pot-pourri of skills including a combination of all or any of cryptograms, crosswords, acrostics, anagrams, probability and logic, apart from just straightforward maths. As an illustration of this sort of thing, and to try out your ability, did you spot anything unusual about this paragraph?

Here are a few hints that you might find useful in solving puzzles of the type found on this page.

1. Read the question. An obvious statement, perhaps, but nevertheless it is surprising how this can be overlooked. Make sure that you know what is required. Have you extracted the maximum amount of information from the question? An odd sentence tucked away in the text may not mean much at first reading, but it may hold a vital clue later on. Is there likely to be a trick anywhere in the question?

2. Plan the work in stages. Work out how you are going to approach the problem. Have a look to see where your computer can best help you, and where the good old-fashioned pencil-and-paper is called for.

3. Writing the program. Efficient programming is the key here. Always check the wording of the question to see if there are any short cuts. For instance, you might find that in testing a series of numbers only the even numbers need be considered. A simple line in your program will achieve that and halve the running time. Conversely, it is not efficient to write a couple of dozen lines if in so doing you take longer than the time that would be saved.

4. Check your results. Always check that the computer is doing just what you want it to. Work out a couple of examples by hand if possible and see that the result is as expected. A bug in the program might not cause it to crash but it can give an erroneous result. For example, a wrongly placed set of brackets in an arithmetical expression — or, when working out angles, are the results given in degrees or radians? Also, don't forget that the computer can only work out values to a certain number of significant figures, and this may also induce certain errors. When you have some results, check them against the original information. Does your answer fit the data?

5. Sleep on it. If, despite all your efforts, you still reach a dead end, put the puzzle away and come back to it later. Try not to be too inflexible as there may be an approach that you have missed. Ask someone else how *they* would tackle it. It may be that they can suggest a different interpretation that you have overlooked.

Obviously, it's not possible to cover all eventualities, but you should now be better equipped to tackle some of these puzzles. A number of readers wrote to say that they had had difficulty with the September puzzle in *Dragon User*, so next month we will be taking a detailed look at the solution.

Now try your skill at this puzzle.

Professor Otto Hex, the well-known mathematician, has sent out his New Year cards to his many friends and associates.

H	A	P	P	Y

N	E	W

Y	E	A	R

As was his usual practice, he also included a suitable brainteaser with the cards to amuse, annoy and puzzle his colleagues. This year was no exception, and what Professor Hex asked them to do was to substitute digits for letters in the greeting "HAPPY NEW YEAR" so that each different letter is to stand for a different digit. This was to be done in such a way that the *numbers* represented by "HAPPY" and "NEW" were to be perfect squares, and the number represented by "YEAR" was to be prime. In order that they could solve the problem the professor also let them know the value of the letter "R", but, unfortunately, I have forgotten what this value was.

What are the numbers?

Prize

THIS MONTH'S PRIZE is the complete library of titles from the official Dragon Data software list produced for the Dragon 32. All 70 titles currently on the market will be sent to the winner by Dragon Data Ltd. Adventure and arcade games, educational programs, languages, sound and graphics programs will be yours to use and enjoy.

Rules

YOUR ENTRY MUST arrive at *Dragon User* by the last working day in January. The winner and the solution to the puzzle will be printed in the April issue.

November winner

THE WINNER OF November's competition and recipient of an MCP-40 Colour Printer/Plotter from Games and Computers is Martin Stentiford of Kingskerswell, Devon. He correctly stated that the next highest tri-perfect was 672.



THE DAN DIAMOND TRILOGY

My name is Diamond, Dan Diamond,

and this is my story. A story of beautiful mermaids, bored robots and dank, dark dungeons. A story that started one muggy day in New York, and like the Big Apple, it's rotten to the core.



The Dan Diamond Trilogy is three separate adventure games. Each game may be played on its own, but clues may be found in the earlier adventures which may help later on. Each game comes with a lavishly illustrated 20-page case file, and hints (both helpful and misleading) which have been hidden in the illustrations.

Part I. Franklin's Tomb, in which our hero receives a mysterious plea for help which leads him to a hidden tomb and the mystery of the stargate.

Part II. Lost in Space, in which our hero finds himself stranded on a derelict spacecraft, doomed to travel endlessly through space, or find a way out.

Part III. Fishy Business, in which our hero lands on a watery planet, discovers the source of the plea for help and saves the day.

All three programs cost £9.95 each and are available for the DRAGON 32, BBC MODEL B and 48k ORIC-1 microcomputers. (note: Fishy Business for the BBC and ORIC will be available February 1984).

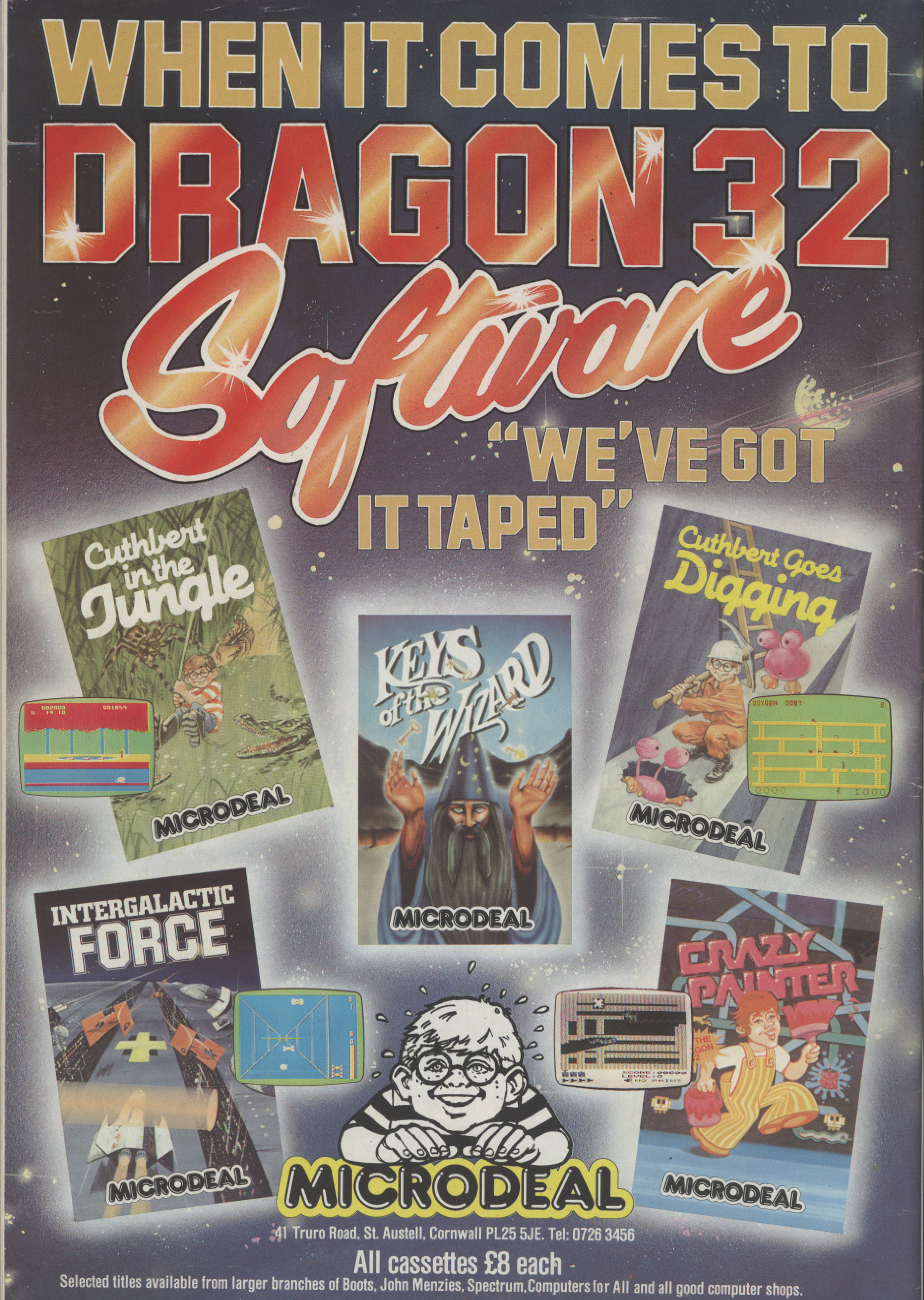
"It must be the most consistently enjoyable adventure game I've ever played"
– Computer Choice (Program of the Month) –

Cheques or postal orders payable to:

Salamander SOFTWARE

17 Norfolk Road, Brighton, East Sussex, BN1 3AA.

Look out for Dan Diamond's next Adventure Series "Franklin in Wonderland" Available Spring 1984


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